

National Aeronautics and
Space Administration



Science Mission Directorate

Weekly Highlights

August 26, 2016

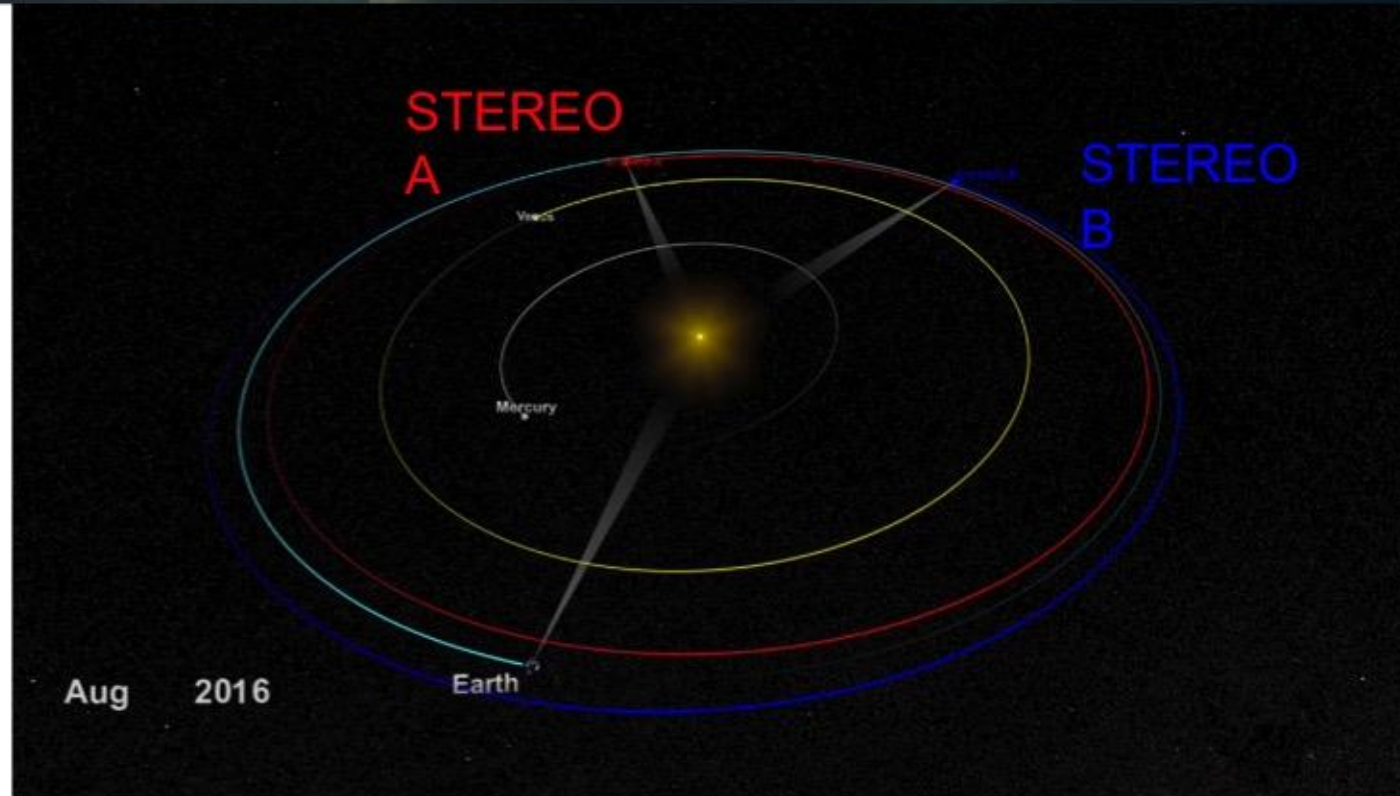


We've Made Contact with STEREO B!

On Aug. 21, 2016, NASA reestablished contact with the spacecraft, after communications were lost in October 2014.

After contact with STEREO-B was lost in October 2014, contact was once again established during a monthly attempt by the Deep Space Network (DSN).

Upon re-establishing communications, the downlink signal was monitored by Mission Operations over several hours, to begin to assess the attitude of the spacecraft. The transmitter was also set to a low-power mode to save battery power.



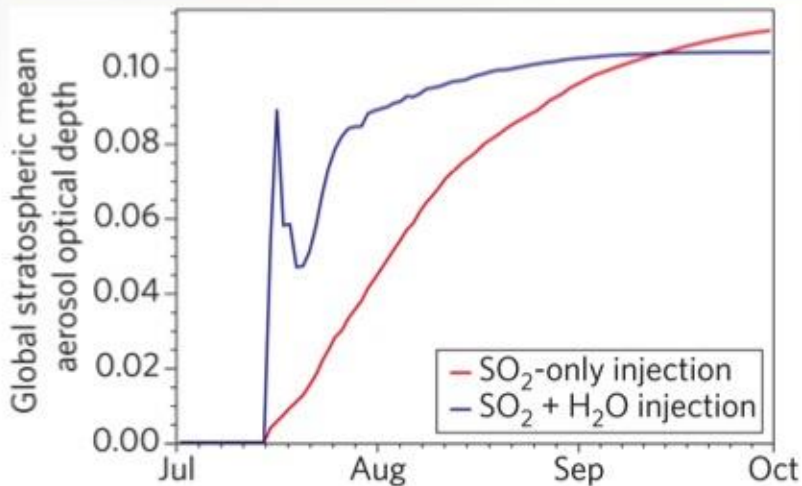
A full recovery plan is being implemented to assess observatory health, re-establish attitude control, and, eventually, evaluate all subsystems and instruments. This process must be carefully prepared, tested and carried out in order to make sure not to re-initiate the problems that led to STEREO losing contact with Earth, and also to make the best use of DSN time.

While full recovery is still uncertain – and could take months – this remarkable development is a tribute to the engineering team that built the spacecraft, to the project for their persistence and patience in possible recovery of the spacecraft, and to the operations team.

Role of Atmospheric Chemistry in The Climate Impacts of Stratospheric Volcanic Injections

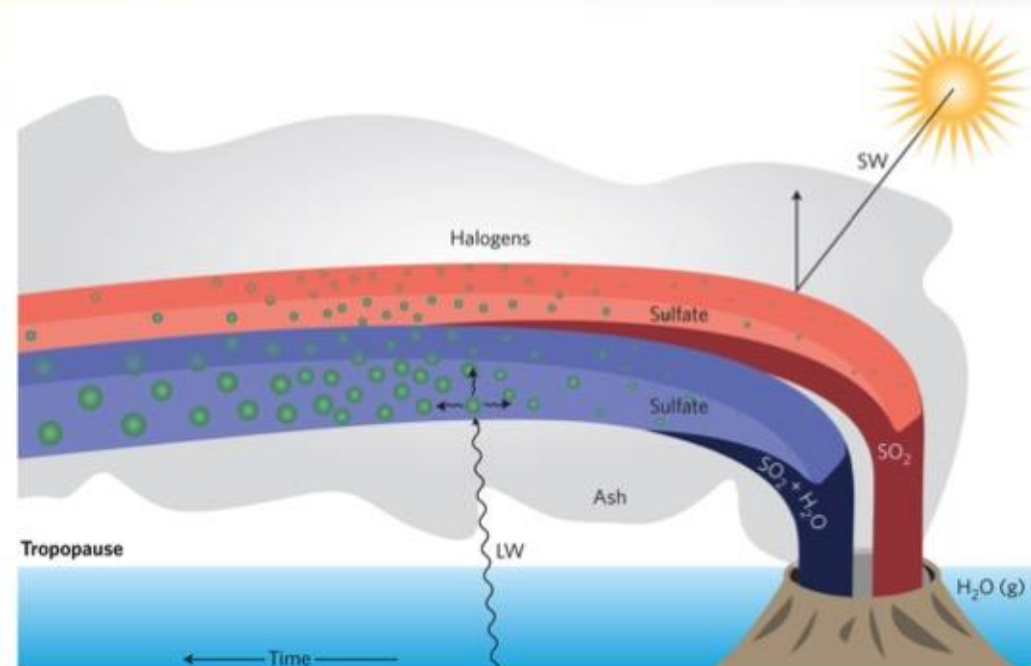
LeGrande, A. N., Tsigaridis, K., & Bauer, S. E. | *Nature Geoscience* | August 2016 | doi: 10.1038/ngeo2771

NASA Goddard Institute for Space Studies (GISS) scientists capitalized on improvements to the aerosol microphysics of the NASA GISS Model E climate model to make a preliminary assessment of how the joint injection of volcanic SO_2 and water vapor modulate stratospheric chemistry, particularly the oxidizing capacity of the stratosphere and the conversion rate of SO_2 to sulfate aerosol. The climate impact of a volcanic eruption is known to be dependent on the size, location and timing of the eruption. However, the chemistry and composition of the volcanic plume also control its impact on climate. It is not just sulfur dioxide gas, but also the coincident emissions of water, halogens and ash that influence the radiative and climate forcing of an eruption. Improvements in the capability of models to capture aerosol microphysics, and the inclusion of chemistry and aerosol microphysics modules in Earth system models, allow us to evaluate the interaction of composition and chemistry within volcanic plumes in a new way. These modelling efforts also illustrate the role of water vapor in controlling the chemical evolution — and hence climate impacts — of the plume. A growing realization of the importance of the chemical composition of volcanic plumes is leading to a more sophisticated and realistic representation of volcanic forcing in climate simulations, which in turn aids in reconciling simulations and proxy reconstructions of the climate impacts of past volcanic eruptions. More sophisticated simulations are expected to help, with predictions of the impact on the Earth system of any future large volcanic eruptions.



Above: Evolution of stratospheric global-mean aerosol optical depth following a volcanic eruption.

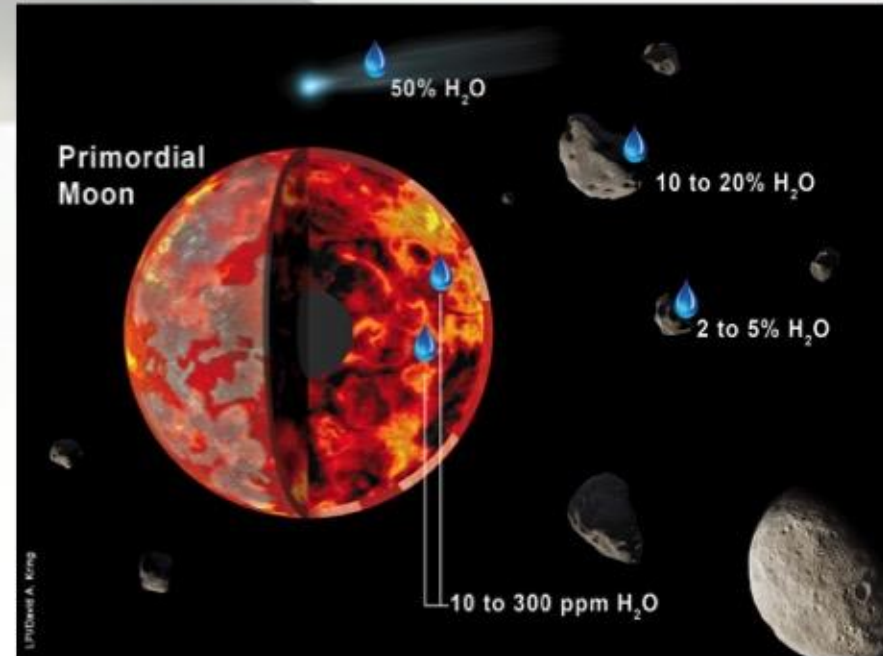
Right: Volcanic water in the stratosphere alters aerosol evolution.



Water Delivery to the Early Moon

New evidence for the origins of water on the Moon challenges the Apollo-era view of a “dry” moon.

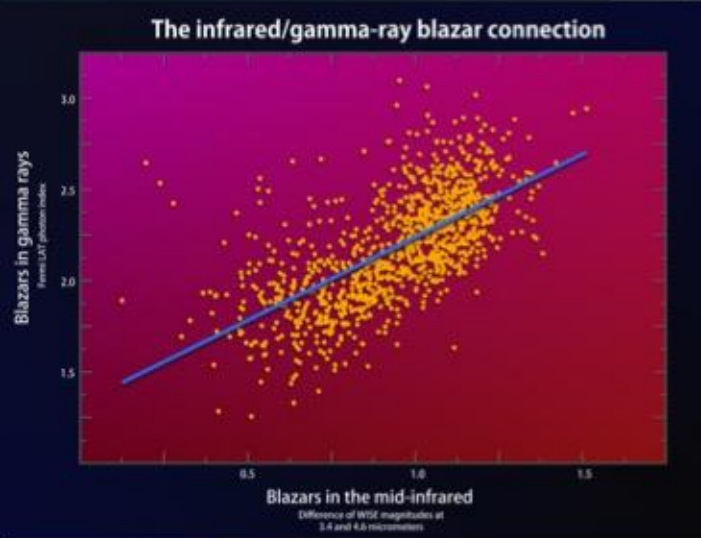
- Researchers combined chemical and isotopic data (e.g. D/H ratios) from lunar samples to determine wet asteroids (primarily carbonaceous chondrites) delivered the majority of lunar water, and comets contributed only a small proportion (>20%) of volatiles to the Moon.
- A bulk water content of ~100 ppm is estimated, and was likely delivered during a period when the surface was covered by a magma ocean, which lasted 10-200 million years after the moon-forming impact. The measured isotopes also indicate that this magma ocean had a conductive lid to prevent significant loss of water.
- This relatively early addition of volatiles indicates that the types of planetary objects impacting the Earth-Moon system were primarily asteroids and not comets for the first 500 million years of geologic history, and that this was likely to be the main source of water delivered throughout the inner solar system.



The Moon may have obtained water when it was still partially molten as its primordial crust was forming. At that time, the Moon was being pummeled by impacting asteroids and comets that deposited water into the lunar interior.

Missions Reveal a Surprising Blazar Connection

Published in the August 9, 2016 issue of *The Astronomical Journal*.



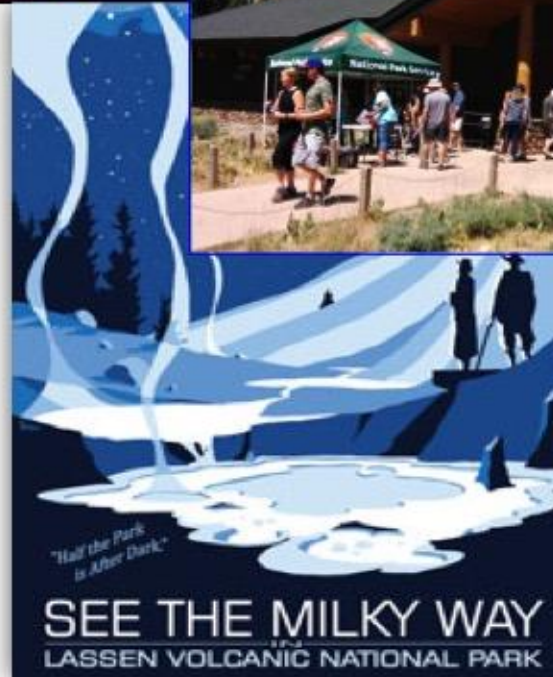
Credit: NASA's Goddard Space Flight Center/Francesco Massaro, University of Turin

An analysis of blazar properties observed by the WISE and Fermi's LAT reveal a correlation in emissions from the mid-infrared to gamma rays, an energy range spanning a factor of 10 billion. When plotted by gamma-ray and mid-infrared colors, Fermi blazars (gold dots) form a unique band not shared by other sources beyond our galaxy. A blue line marks the best fit of these values.

- Astronomers studying distant galaxies powered by monster black holes have uncovered an unexpected link between two very different wavelengths of the light they emit, the mid-infrared and gamma rays. The discovery, which was accomplished by comparing data from NASA's Wide-field Infrared Survey Explorer (WISE) and Fermi Gamma-ray Space Telescope, has enabled the researchers to uncover dozens of new blazar candidates.
- Blazars constitute more than half of the discrete gamma-ray sources seen by Fermi's Large Area Telescope (LAT). At the heart of a blazar lies a supersized black hole with millions of times the sun's mass surrounded by a disk of hot gas and dust. As material in the disk falls toward the black hole, some of it forms dual jets that blast subatomic particles straight out of the disk in opposite directions at nearly the speed of light. A blazar appears bright to Fermi for two reasons. Its jets produce many gamma rays, the highest-energy form of light, and we happen to be viewing the galaxy face on, which means one of its jets is pointing in our direction.
- From January to August 2010, WISE mapped the entire sky in four infrared wavelengths, cataloging more than half a billion sources. In 2011, a group of scientists began using WISE data to investigate Fermi blazars. Using WISE data allowed scientists to study the mid-infrared colors of known gamma-ray blazars.
- The electrons, protons and other particles accelerated in blazar jets leave a specific "fingerprint" in the infrared light they emit. This same pattern is also clearly evident in their gamma rays. The relationship effectively connects the dots for blazars across an enormous swath of the electromagnetic spectrum.
- About a thousand Fermi sources remain unassociated with known objects at any other wavelength. Astronomers suspect many of these are blazars, but there isn't enough information to classify them. The infrared/gamma-ray connection led the researchers to search for new blazar candidates among WISE infrared sources located within the positional uncertainties of Fermi's unidentified gamma-ray objects. When the researchers applied this relationship to Fermi's unknown sources, they quickly found 130 potential blazars. Efforts are now under way to confirm the nature of these objects through follow-up studies and to search for additional candidates using the WISE connection.

Webb Telescope featured at The 5th Annual *Dark Sky Festival*

- On August 12-14, 2016, Lassen Volcanic National Park in California hosted the fifth annual Dark Sky Festival
- The festival consisted of nightly constellation tours and stargazing; daily astronomy activities, discussions, and demonstrations
- Dr. Bonnie Meinke delivered the keynote evening talks about James Webb Space Telescope's Search for Life in the Universe
- The Space Telescope Augmented Reality (STAR) app was featured at the Kohm Yah-mah-nee Visitor Center for the duration of the festival
- A selection of lithographs featuring information about the Webb Telescope and infrared astronomy were provided for all park visitors



For more information please visit:

<https://www.nps.gov/lavo/planyourvisit/stargazing.htm>