



SDO Science Workshop:  
A Gathering of the Helio-hive!  
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Invited talk: **On the farside of solar cycle 25:  
Observations of a high-speed space weather  
event at Mars**

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Solar cycle 25 has exceeded predictions of a mild solar cycle. Strong events like the May 2024 Gannon storm have affected planets across the solar system. Mars is particularly vulnerable to inclement space weather since it lacks an intrinsic magnetosphere like Earth. Instead, interplanetary magnetic field carried with the incident solar wind flow induces currents in the ionosphere to form an "induced magnetosphere" that decelerates and deflects the solar wind depending on the ambient interplanetary plasma conditions<sup>1</sup>. CMEs that strike Mars can compress the induced magnetosphere, increasing energetic particle access to the atmosphere and draining some of the ionosphere into space<sup>2</sup>.

In December 2023, a fast CME overtook a high-speed solar wind stream and impacted Mars. Although the impact was brief (<1.5 days), the conditions were extreme, with solar wind velocity exceeding 850 km/s. Ionospheric composition became enriched in C<sup>+</sup> and O<sup>++</sup><sup>3</sup>, magnetization substantially increased, and many auroras were recorded.

Since no solar imager is permanently located near Mars, we rely on other assets for solar context. However, Mars was located on the other side of the sun relative to Earth at the time. We synthesized same-day SDO HMI farside holography with low-resolution solar images taken from the surface of Mars by the Perseverance rover alongside prior views of the active region acquired by SDO AIA. SDO helped us determine that the CME's unusual characteristics may have been linked to a proximal coronal hole, which can knock a CME out of the ecliptic<sup>4</sup>. This result, among others, will be reported in a soon-to-be-submitted study.

**Dr. Rebecca Jolitz** is a postdoctoral researcher at the University of California Berkeley Space Sciences Laboratory (UCB SSL). A member of the MAVEN spacecraft science team, Dr. Jolitz studies space weather at Mars, from recent extreme events to the historical influence on Mars' atmospheric development. She attained a Ph. D. in Physics from the University of Colorado Boulder in 2022 for her thesis, "Solar energetic particles at Mars".

To the workshop organizers, the award committee, my SPD sponsors, the SDO community, the MAVEN team, my coauthors, and Thomas Metcalf's family: **thank you**. Without this travel grant, I wouldn't have been able to attend, let alone present. I made new research colleagues and facilitated connections between my colleagues and the solar community. It was a privilege to share the view from Mars with such an excellent mission team.



Bibliography: <sup>1</sup>Nagy et al. 2004 (doi: [10.1007/978-0-306-48604-3\\_2](https://doi.org/10.1007/978-0-306-48604-3_2)), <sup>2</sup>Lee et al. 2017 (doi: [10.1029/2018GL079162](https://doi.org/10.1029/2018GL079162)), <sup>3</sup>Hanley et al. 2024 (doi: [10.1029/2024GL111676](https://doi.org/10.1029/2024GL111676)), <sup>4</sup>Mäkelä et al. 2013 (doi: [10.1007/s11207-012-0211-6](https://doi.org/10.1007/s11207-012-0211-6))