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Global aurora on Mars during the September 2017 Space Weather Event

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In September 2017, the Imaging UltraViolet Spectrograph (IUVS) on the MAVEN spacecraft observed global aurora on Mars caused by a surprisingly strong solar energetic particle event. Widespread “diffuse aurora” have previously been detected on Mars through more limited observations (Schneider et al., Science 350, (2015); DOI: 10.1126/science.aad0313), but the recent observations established complete coverage of the observable portion of Mars’ nightside. The aurora was global due to Mars’s lack of a global magnetic field, which allowed energetic electrons from the Sun to directly precipitate into the atmosphere. On September 11th, IUVS detected aurora more than 25 times brighter than any prior IUVS observation, with high SNR detections of aurora at the limb and against the disk of the planet. Fainter auroral emission was seen around the nightside limb over 13 orbits spanning nearly 3 days. We will present a review of the auroral images and limb scans along with MAVEN measurements of solar energetic particles responsible for the event.

On September 14th, during the declining phase of the event, IUVS detected faint linear features and patches. These features were above the the noise floor, with a similar spatial distribution to “discrete aurora” patches observed on Mars by the SPICAM instrument on the Mars Express spacecraft (Bertaux et al., Nature 435, doi :10.1038/nature03603). Discrete aurora occur near areas of the crust affected by the magnetism left over from Mars’ once-strong dipole field. Emission is limited to regions of the crustal magnetic field where the field lines are likely to be open to solar wind interactions. Those regions are concentrated in Mars’ southern hemisphere centered on 180 degrees east longitude. We studied the localized emissions on 14 September to determine whether there might be a connection between the observed diffuse aurora event and discrete auroral processes. We confirmed that the observed signal of the localized emission was consistent with expected auroral spectra, and that their locations coincide with open magnetic field lines regions on crustal magnetic fields maps.