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Overview of the Martian nightside suprathermal electron depletions

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Nightside suprathermal electron depletions have been observed at Mars by three spacecraft to date: Mars Global Surveyor (MGS), Mars EXpress (MEX) and the Mars Atmosphere and Volatile EvolutioN (MAVEN) mission. The global coverage of Mars by MEX and MGS at high altitudes (above approximately 250 km) revealed that these structures were mostly observed above strong crustal magnetic field sources which exclude the electrons coming from the dayside or from the tail. The MAVEN orbit now offers the possibility to observe this phenomenon at low altitudes, down to 125 km. A transition region near 170 km has been detected separating the collisional region where electron depletions are mainly due to electron absorption by atmospheric CO_2 and the collisionless region where they are mainly due to closed crustal magnetic field loops.
MAVEN is now in its third year of data recording and has covered a large range of latitudes, local times and solar zenith angles at low altitudes (<900km) in the nightside. These observations enable us to estimate where the EUV terminator is located, based on the observation that no electron depletions are expected above its location. Through this study the location of the EUV terminator appears to be raised on average by 125 km above the location of the geometrical terminator. However, this location is likely to be different between the dawn and dusk terminator and to vary throughout the different Martian seasons. This coverage has also allowed the observation of regions with recurrent absence of electron depletions even below the transition region near 170 km altitude. These 'no-depletion' areas are localized above the least magnetized area of Mars both in the Northern and Southern hemispheres. A modification in the CO_2 density, gravity waves, or the presence of current sheets are potential drivers for that phenomenon.