# Dawn–Dusk Asymmetries in the Martian Upper Atmosphere

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In last couple of decades, planet Mars has gained a large attention of scientific community primarily due to continuous loss of its atmosphere to the outer space. Mars exploration missions such as the Mars Atmosphere and Volatile EvolutioN (MAVEN), Mars Orbiter mission (MOM), MARS Express and Mars Global Surveyor (MGS) has unfolded a lot of hidden secrets of Mars and the dynamics involved in its atmospheric loss processes. To quantify these loss channels and to improve atmospheric models at Mars, it is important to study the variability of its atmosphere and to find important features and asymmetries present in its upper atmosphere. This talk presents the first comprehensive observations of local time asymmetries in densities and scale heights (temperatures) of the Martian upper atmosphere (between 150 km and 300 km) measured by the Neutral Gas and Ion Mass Spectrometer aboard MAVEN. In general, the daytime densities and temperatures are greater than the night time values. The maximum and minimum values, however, are observed at the dusk and dawn terminators, respectively. An enhancement at the dusk terminator is persistently observed at all altitudes; however, the time of the peak enhancement shifts towards sunlit hours with increasing altitude. At the dawn terminator, a minimum in density is observed at altitudes of 150–170 km. At higher altitudes, the minimum is observed close to midnight. Accordingly, the dawn–dusk asymmetry is more prominent at 150–170 km and decreases with increasing altitude. The observed asymmetry is explained in terms of dynamical heating and cooling due to convergent and divergent winds at the dusk and dawn terminators, respectively. In addition, upward propagating gravity waves generated by the solar terminator wave and $O/CO_2$ radiative cooling are also proposed as important mechanisms contributing to the observed asymmetry.