Department of Physics and Materials Science

SEMINAR

Mars' induced magnetosphere and its role in atmospheric loss as evidenced by the MAVEN mission.

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Abstract: There are many features on the surface of Mars that indicate the presence of liquid water in the past, which could only be maintained through the existence of a thick enough atmosphere. However, sometime around 3 billion years ago the red planet dried up and today only has a tenuous atmosphere of 0.006 bars. One possible culprit for the fate of the Martian atmosphere is the solar wind. The sun constantly emits a stream of ionized particles from its upper atmosphere and drags the solar magnetic field with it through the solar system. Travelling at an average speed of 450 km/s, the solar wind has the potential to strip away atmospheric particles as it interacts with the planets and other bodies. But as evidenced by our comfortable existence here on Earth, different planets have been able to sustain their atmosphere over time. We ask then how Mars evolved so differently from Earth, with an atmospheric pressure of 1 bar, and both these planets from Venus, which has an atmosphere of 93 bars? On one hand, the Earth has an intrinsic magnetic field that acts as a barrier to solar wind pressures. However, Venus and Mars do not possess an intrinsic magnetic field. Rather, the contact between the solar wind and these planets' atmospheres creates what is known as an induced magnetosphere. Between these two planets, there are critical differences in the structures of their induced magnetospheres. The Mars Atmosphere and Volatile EvolutioN (MAVEN) mission has been orbiting Mars since 2014 and collecting atmospheric and plasma data in an attempt to explain the evolution of the Martian atmosphere. Here, we use MAVEN data to describe the boundary between the solar wind plasma and plasma of planetary origin through analysis of dominant plasma pressures. By studying this boundary, we can decipher to what extent the solar wind can influence atmospheric loss.

Bio: Skylar Shaver is a PhD student at the University of Colorado at Boulder, and is conducting research on the Mars Atmosphere and Volatile EvolutioN (MAVEN) mission. She is currently investigating the Martian ionosphere using the Langmuir Probes and Waves (LPW) instrument on board MAVEN. She has previously worked on the Gravity Recovery and Climate Experiment (GRACE) and Cassini-Huygens missions, and has investigated Active Galactic Nuclei (AGN) using data from the W.M. Keck Observatory Telescopes.

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