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**PRESS RELEASE**

**New research unveils the dynamic battle between Mars atmosphere and the solar wind**

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*Qi Zhang's research at the Swedish Institute of Space Physics and Umeå University, provides insights into how the atmosphere on Mars has evolved over time and may look like in the future. Photo: IRF*

**In her doctoral thesis, Qi Zhang explores the interaction between Mars and the stream of charged particles from the Sun, the solar wind. Her research provides new insights for understanding how the atmosphere of Mars have evolved over time.**

Unlike Earth, Mars lacks a global magnetic field and interacts with the solar wind directly. Over billions of years, this interaction has stripped much of the Martian atmosphere, transforming the planet from a warm, wet world into the cold, arid landscape we see today.

Qi’s research introduces a groundbreaking approach to study this process, focusing on the escape of heavy ions from Mars.

By combining data from Mars satellites with advanced computer models, the study unveils how solar activity - such as solar radiation, solar dynamic pressure and interplanetary magnetic field - affects the atmospheric escape rate.

“*My method allows us to estimate how much of Mars’ atmosphere is being lost to space under different conditions and understand the forces driving this process. This is crucial for piecing together the planet’s history and predicting its future*,” says Qi.

One of Qi’s key discoveries is the concept of a degenerate induced magnetosphere - a state in which extreme solar wind conditions trigger a unique interaction feature and a surge in atmospheric escape. These findings have broader implications for planetary science, including the study of exoplanets and their interactions with stellar winds.

Qi’s studies not only deepen our understanding of Mars but also have practical implications for future exploration.

Her research is based on computer models and observations from scientific instruments, as IRF’s Analyzer of Space Plasmas and Energetic Atoms (ASPERA-3), onboard the ESA spacecraft Mars Express and NASA’s spacecraft MAVEN, both of which orbit around Mars.

Qi Zhang, born in China, defends her PhD thesis “*Modeling the effects of solar conditions on the interaction of the solar wind with Mars*” on Friday the 7th of March 2025 in the auditorium at IRF in Kiruna. The faculty opponent is Dr Michael Chaffin from the University of Colorado Boulder in the USA.   
 **Link to the thesis:**   
<https://umu.diva-portal.org/smash/record.jsf?pid=diva2%3A1934828&dswid=3479>  
  
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