Aeronomy of Mars and Venus

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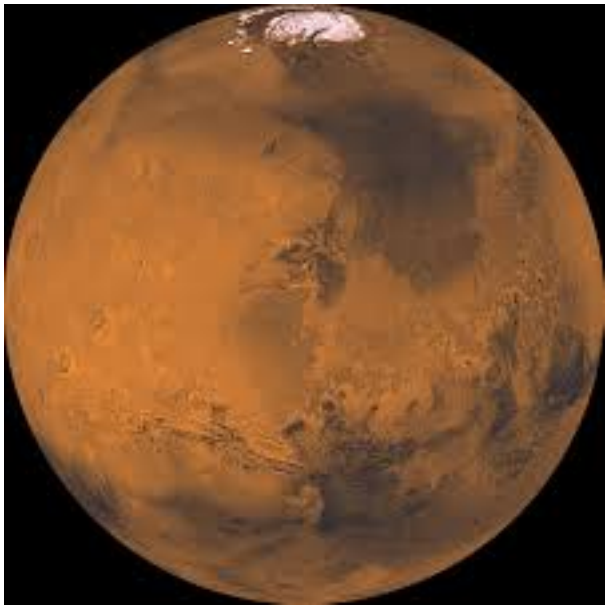

The upper atmosphere of Mars is currently being explored in unprecedented detail simultaneously by 3 spacecraft. Nasa's MAVEN mission is the first ever mission dedicated to exploring Mars' atmosphere above 100 km in-situ, revealing a thin atmosphere composed primarily of CO_2 and O, followed by nitrogen and other carbon based species as well as a plethora of ionised species. Throughout 2017, ESA's ExoMars Trace Gas Orbiter (TGO) which is currently also orbiting Mars performed aerobraking, whereby the spacecraft for 1 year regularly passed through the atmosphere and was decelerated by the aerodynamic drag. The onboard accelerometers measured this deceleration and allowed us to reconstruct vertical atmosphere density profiles, giving information about the temperature and atmospheric waves. Accurate spacecraft tracking of the TGO as well as radio occultation

experiments have further helped measure the upper atmosphere of Mars with the TGO. Thirdly, ESA's Mars Express spacecraft is currently in orbit around Mars, performing remote sensing observations of its upper atmosphere.

The PhD project will consist in bringing the relevant datasets from all 3 missions together in order to build a global picture of density variations in space and time, their variability in response to external forcing from the Sun and solar wind as well as internal oscillations (waves). The project can, depending on the interest of the candidate, involve numerical simulations to also infer other parameters not directly measured, such as atmospheric winds.

Results for Mars will be compared and contrasted with observations of Venus by the Pioneer Venus orbiter and the Venus Express spacecraft to gain a deeper understanding of what drives the atmospheres on both planets and what distinguishes them on a physics level. Another potential topic for investigation at Mars is that of atmospheric escape, addressing the question of how and why Mars lost most of its atmosphere.

The candidate should have a keen interest in planetary atmospheres, some computational and programming experience (IDL, Fortran, Matlab amongst other) and some level of training/ background in space and/or atmospheric physics.