Aeronomy of Mars with ExoMars

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The upper atmosphere of Mars is currently being explored in unprecedented detail by Nasa's MAVEN mission, revealing a thin atmosphere composed primarily of CO$_2$ and O, followed by nitrogen and other carbon based species. Furthermore, the Sun's radiation as well as energetic plasma from the plasma surrounding of Mars cause ionisation of the upper atmosphere, forming an ionosphere. In Spring of 2017, ESA's ExoMars Trace Gas Orbiter (TGO) will perform aerobraking, whereby the spacecraft for around 9 months regularly passes through the atmosphere and is decelerated by the aerodynamic drag. The onboard accelerometers measure this deceleration and allow us to reconstruct vertical atmosphere density profiles, giving information about the temperature and atmospheric waves.

The PhD project will focus on the analysis of data from the ExoMars TGO spacecraft as well as Nasa's MAVEN mission and use numerical simulations to understand the underlying physical processes of the observed behaviour. The aim of the work is to understand the global structure (densities, temperatures) as well as periodicities (atmospheric waves) and seasonal, orbital as well as short term variability. Numerous atmosphere models have been developed for other planets, and the task of the PhD student would be to apply these to the Martian environment. Results for Mars will be compared and contrasted with Venus, Earth and Titan to gain a deeper understanding of what drives the boundary layer on Mars between atmosphere and space environment. Another potential topic for investigation is that of atmospheric escape, addressing the question of how and why Mars lost most of its atmosphere.

The ideal candidate should have some computational and programming experience (IDL, Fortran, Matlab amongst other) and ideally some training/background in space and/or atmospheric physics.