

Atmospheric retrievals from the NOMAD instrument on the ExoMars Trace Gas Orbiter mission

Supervision team: Dr Manish Patel, Prof. Stephen Lewis, Dr Jon Mason, Dr Paul Streeter

Lead contact: [Dr Manish Patel](#)

Description:

This PhD will analyse spacecraft data from the NOMAD instrument on the ExoMars Trace Gas Orbiter (TGO) mission to Mars. The ExoMars TGO mission is searching for trace gases on Mars, some of which could be linked to the presence of life. The Nadir and Occultation for Mars Discovery (NOMAD) instrument [1] is one of four instruments on TGO, and is co-led by the Open University. NOMAD is an optical spectrometer capable of measuring a range of trace gases in unprecedented detail, and this project provides an opportunity to work within the NOMAD team to search for these trace gases. This work will have the potential for high impact both scientifically and from a public interest perspective.

TGO has been in orbit around Mars for over one martian year and throughout this time NOMAD has mapped the spatial and temporal distributions of trace gases and aerosols at a global scale, as well as measuring their vertical profiles and diurnal cycle.



The Open University is responsible for the science exploitation of the UV-visible (UVIS) channel [2] of the NOMAD instrument. This project is aimed at performing atmospheric retrievals of gases such as ozone, and aerosols such as dust and ice clouds from the latest NOMAD observations as they arrive. This will ultimately result in new knowledge on the spatial and temporal variation of these atmospheric species in previously unexplored areas. By using and developing a radiative transfer/retrieval model, the applicant will work as part of the core NOMAD team working on the very latest mission data before it is publicly released. Project specific activities will focus on terminator science; namely the ozone photochemistry and the formation of terminator clouds, and exploiting high solar zenith angle observations by the UVIS visible channel data, which have not yet been analysed. It will also provide the opportunity to work within the international NOMAD team, spread across the UK, Belgium, Spain, Italy and the US, as well as the opportunity to work with the European Space Agency.

This exciting project provides the opportunity to be at the cutting edge of martian atmospheric research at a time when new missions are arriving at Mars, providing the opportunity to establish new international collaborations.

References:

1. Neefs, Eddy, et al. "NOMAD spectrometer on the ExoMars trace gas orbiter mission: part 1—design, manufacturing and testing of the infrared channels." *Applied optics* 54.28 (2015): 8494-8520.

2. Patel, M.R., Antoine, P., Mason, J.P., Leese, M.R., Hathi, B., Stevens, A.H. Dawson, D., Gow, J.P.D., Ringrose, T.J. et al. (2017). NOMAD spectrometer on the ExoMars trace gas orbiter mission: part 2—design, manufacturing, and testing of the ultraviolet and visible channel. *Applied Optics*, 56(10) pp. 2771–2782.

Qualifications required:

Suitable for graduates with a physics, mathematics or related numerate undergraduate degree, particularly those with an interest in numerical modelling. Some knowledge of atmospheric science, such as a relevant course within an M.Phys. or M.Sc. would be helpful, but not essential.