UNIVERSITY OF LEICESTER

Development of Data Analysis and Exploitation Tools for Future Astrobiology Missions

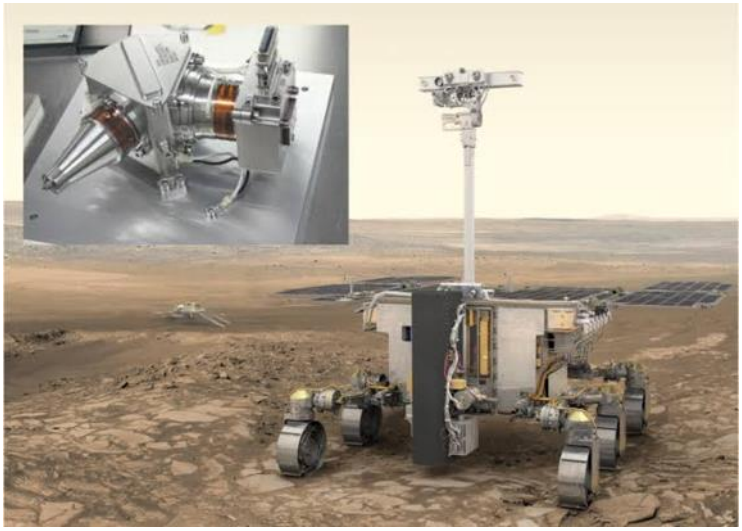
• Development of rapid and intelligent spectral and image analysis tools for astrobiology missions (e.g. ExoMars). • Habitability assessment through characterising biosignatures within analogue material from field activities. • Training in surface operations and real-time data analysis for future surface missions.	**Level**	PhD
	First Supervisor	Dr. Melissa McHugh
	Second Supervisor	Dr. Hannah Lerman
	Application Closing Date	17th January 2027
	PhD Start date	27th September 2027

Project Details:

Upcoming astrobiology missions will explore the Martian surface (ESA's ExoMars mission), ocean worlds (L4 Enceladus exploration) and sample active icy surfaces (NASA's Europa lander), to search for chemical biosignatures and habitable environments across our solar system. However, as exploration missions become more advance, innovative technologies and measurement techniques become critical in order to meet far reaching astrobiology science goals. In anticipation of these missions, this project will focus on the design and development data analysis exploitation tools for future space missions, focusing on the rapid and detailed characterisation of surface minerology, geology and the assessment of potential habitability. Using multi-wavelength spectroscopy and imaging techniques (representative of state of the art mission payloads), this work will focus on the characterisation of CHNOPS elements, possible metabolic energy sources, and liquid water as sign posts for solar system habitability. The work will also focus on using specialist analytical instrumentation and developing novel data analysis techniques in order to characterise signs of habitability in planetary analogue samples, with emphasis on measurements in extreme environments and field locations.

The project is strongly linked to the work currently being performed by the supervisor team to prepare for the launch and landing of ESA's ExoMars Rover in 2028/2029 (the supervisors are part of ESA's ExoMars Raman Laser Spectrometer group). In preparation for surface operations, the team are performing analysis on mission sample sets, completing astrobiology field campaigns, performing environment simulations and developing a database tools for the Raman Laser Spectrometer. The successful candidate will have the opportunity to be involved in ExoMars mission sample analysis, work with members of the ExoMars consortium and build upon the data exploitation tools currently being prepared for the ExoMars surface mission.

Images:



ESA's ExoMars rover, due to launch in 2028. Insert: The Raman Laser Spectrometer, which is situated inside the rover's main body.

Further Reading:

- Rull, F., Maurice, S., Hutchinson, I., Moral, A., Perez, C., Diaz, C., ... & RLS team. (2017). The Raman laser spectrometer for the ExoMars rover mission to Mars. Astrobiology, 17(6-7), 627-654.
- McHugh, M., Parnell, J., Hutchinson, I. B., Lerman, H. N., Edwards, H. G., Burchell, M. J., ... & Rull, F. (2021). Raman analysis of a shocked planetary surface analogue: Implications for habitability on Mars. Journal of Raman Spectroscopy, 52(12), 2166-2177.
- Hutchinson, I. B., Ingley, R., Edwards, H. G., Harris, L., McHugh, M., Malherbe, C., & Parnell, J. (2014). Raman spectroscopy on Mars: identification of geological and bio-geological signatures in Martian analogues using miniaturized Raman spectrometers. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 372(2030), 20140204.

Further Details

- **Proposed Funding Source:** STFC
- **Proposed Start Date:** 27th September 2027 for 3.5 years.
- **Closing Date:** 23:59 Sunday 17th January 2027.
- **Eligibility:** UK/EU/International; fee waivers will be available for small number of international students; otherwise international applicants must show that they can cover the fee difference between UK/International costs (~£16k/year).
- **Entry requirements:** Applicants are required to hold/or expect to obtain a UK Bachelor Degree 2:1 or better in a relevant subject. The University of Leicester English language requirements apply where applicable.
- **Application enquiries to pgradmissions@le.ac.uk**

Further information on how to apply and funding can be found here