
Multi-Disciplinary Scientist

I am an experienced multi-disciplinary planetary scientist with a background in chemistry, physics and planetary science, specializing in analytical spectroscopy of minerals and organic molecules in complex real-world samples. I am currently a Marie Curie research fellow at the Natural History Museum in London, where I study microplastic pollution and its impact on seabirds. I am also a member of the Science Team for NASA's *Mars 2020* mission, providing data analysis and interpretation of Raman and fluorescence spectra acquired by the SHERLOC instrument onboard the *Perseverance* Mars rover. I am a passionate advocate for inclusivity and diversity in STEM, and the ethical exploration of space.

Technical & Behavioural Competencies

Scientific Knowledge & Management

- Broad scientific background: chemistry as an undergraduate, material physics as a postgraduate, planetary science and environmental science as a postdoctoral researcher.
- Expert in Raman spectroscopy, experience with UV-Vis absorption, fluorescence, FTIR, and CT scanning to characterize both chemical and physical properties of a broad range of samples
- Research focus on the use of spectroscopic techniques to detect and identify organic molecules and materials, and to study their degradation under various environmental conditions.
- Worked with NASA scientists & engineers to calibrate and operate the SHERLOC instrument on Mars.
- Managed collaborations with US, UK, and international researchers across several universities on research projects that involved preparation, handling and curation of limited samples.
- Experienced at coordinating laboratory analysis and curation of large field sample collections (100-1500 items) to ensure that samples are tracked and used as effectively as possible.

Research/Publication Record

- Published 10 papers as first author, 9 papers as co-author, and 1 ebook over the past 9 years, with 4 further papers accepted or under review.
- Joint first author on a paper currently under 2nd review for the journal *Science*, outlining the initial results and analysis from SHERLOC.
- My 2020 paper on quantitative Raman spectroscopy was described as “an outstanding tour de force” during peer review and was published with minimal corrections.

Communication & Ambassadorship

- Invited talks on the use of Raman spectroscopy in planetary science, at Caltech (USA), Oxford University (UK), University College London (UK), and Imperial College London (UK).
- Invited speaker/panellist for events on diversity and inclusion in STEM at the Royal Society (UK), Royal Institution (UK) and the American Geophysical Union Fall Meeting (USA).
- Designed promotional and education materials for science outreach and diversity events.
- Trustee of the UK charity *Pride in STEM*, coordinating events for LGBT+ scientists and students.

Relationship Management

- Worked closely with both NASA employees and international researchers involved in other Mars exploration missions to advance our collective understanding of planetary science.
- Mentored/supervised multiple undergraduate students and JPL interns, as well as junior postdocs.
- Organised, motivated, and engaged member of any team.

Problem Solving

- Able to adapt to new situations and new research fields, and pride myself on leveraging my broad knowledge base to find new solutions to complex problems.

Professional Experience

MARIE SKŁODOWSKA-CURIE RESEARCH FELLOW

Natural History Museum, London, UK

Feb 2022 – Present

Awarded a two-year individual fellowship for my proposal to characterize microplastics ingested by the flesh-footed shearwater, *Ardenna carneipes*, and determine the relationships between physical/chemical properties of plastics and the physiological health of seabirds that eat them. As part of the project, I am developing new, multi-technique methodologies for consistent and detailed characterization of individual microplastic fragments using CT scanning, analytical photography, FTIR, and Raman spectroscopy.

NASA POSTDOCTORAL FELLOW, SCHOLAR

NASA Jet Propulsion Laboratory, Pasadena CA, USA

Jan 2018 – Dec 2021

Awarded a two-year NASA Postdoctoral Program fellowship for my proposal to develop quantitative methodologies for UV Raman and fluorescence spectroscopy in planetary science, followed by two years as a JPL postdoctoral scholar. As a member of the *Mars 2020* and SHERLOC science teams, I provided operational and technical expertise on the collection and interpretation of UV Raman and fluorescence spectra by the arm-mounted SHERLOC instrument. I was responsible for developing the spectral library and analytical protocols necessary for the detection and identification of minerals and potential biosignatures on Mars using SHERLOC, which will inform sample selection for caching and eventual return to Earth.

VISUAL EFFECTS ARTIST

Self-employed, London, UK

Aug 2007 – Jan 2018

Freelance work on advertisements, TV dramas and feature films. This involved working independently to solve problems, meet goals and produce high quality artistic products within strict deadlines.

Education

Doctor of Philosophy (PhD), Physics

2012 – 2016

Imperial College London, UK

Thesis: "Understanding Morphology and Photostability of Organic Solar Cells via Advanced Structural Probes"

Conducted novel research using advanced analytical techniques (including resonant Raman spectroscopy, surface-enhanced Raman spectroscopy, atomic force microscopy) to probe the nanoscale morphology and photo-stability of organic solar cells that use low-cost & printable blends of semiconducting organic molecules to generate electricity.

Master of Research (MRes) – Distinction

2011 – 2012

Imperial College London, UK

Trained in the synthesis, fabrication and characterization of organic semiconductors and next-generation plastic electronic devices.

Master of Chemistry (MChem) – 1st Class with Honours

2007 – 2011

University of Sussex, UK

4 year undergraduate Masters degree accredited by the Royal Society of Chemistry, covering physical, organic and inorganic chemistry with a personal specialisation in analytical and theoretical chemistry.

Diversity and Inclusion Work

- Trustee of the *Pride in STEM* charity in the UK, and co-organiser of the 2017 *Out Thinkers* event series, which celebrates the lives and work of LGBT+ scientists and engineers.
- Designed several freely available materials (posters, flyers, stickers) for raising awareness of LGBT+ scientists, addressing issues and promoting more inclusive policies in STEM.
- Invited panellist for the “100 years of LGBTQ+ Geoscientists” Town Hall at the American Geophysical Union 2019 Fall Meeting, and the “Out in STEM 2017” event at the Royal Society.
- Published articles on LGBT+ issues and experiences in STEM, including a guest contribution to the Royal Society’s *In Verba* blog, and two articles in *Digital Science*.

Awards

- Recipient of a *Mars 2020* “exceptional contribution” award, for my work on SHERLOC.
- Murrell Prize for Theoretical Chemistry at Sussex University, for my Masters dissertation on atomic diffusion of lithium ions in graphite lattices.

Publications & Presentations

Selected Scientific Publications:

- E. Scheller & J. Razzell Hollis *et al.* “Aqueous alteration processes and implications for organic geochemistry in Jezero crater, Mars”, *in review*
- K. Hickman-Lewis *et al.* (2022) “In situ identification of microbial biosignatures using co-located Perseverance analyses: a case study from the Palaeoarchaeon”, *accepted by Astrobiology*
- K.R. Moore *et al.* (2022) “Biosignature preservation aided by organic-cation interactions in proterozoic tidal environments”, *accepted by Palaios*
- J. Razzell Hollis *et al.* (2022b) “A Deep-Ultraviolet Raman and Fluorescence Spectral Library of 51 Organic Compounds for the SHERLOC instrument onboard Mars 2020”, *accepted by Astrobiology*
- J. Razzell Hollis & K. R. Moore *et al.* (2022a) “The power of paired proximity science observations: Co-located data from SHERLOC and PIXL on Mars”, *Icarus*, *in press*
- J. Razzell Hollis *et al.* (2021c) “A deep-ultraviolet Raman and Fluorescence spectral library of 62 minerals for the SHERLOC instrument onboard Mars 2020”, *Planetary and Space Science* 209, 105356.
- K. Uckert *et al.* (2021) “Calibration of the SHERLOC Deep Ultraviolet Fluorescence–Raman Spectrometer on the Perseverance Rover”, *Appl. Spectrosc.* 75 (7), 763-773
- J. Razzell Hollis *et al.* (2021b), “Detection and Degradation of Adenosine Monophosphate in Perchlorate-Spiked Martian Regolith Analog, by Deep-UV Spectroscopy”, *Astrobiology* 21 (5), 511-525.
- R. Bhartia *et al.* (2021), “Perseverance’s Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals (SHERLOC) Investigation”, *Space Science Reviews* 217 (4), 1-115.
- V. Fox *et al.* (2021) “Synthesis and characterization of Fe(III)-Fe(II)-Mg-Al smectite solid solutions and implications for planetary science” *American Mineralogist* 106 (6), 964-982.
- J. Razzell Hollis *et al.* (2021a) “Deep-Ultraviolet Raman Spectra of Mars-Relevant Evaporite Minerals under 248.6 nm Excitation”, *Icarus* 357, 114067.
- P. E. Martin *et al.* (2020) “Studies of a Lacustrine-Volcanic Mars Analog Field Site with Mars-2020-like Instruments”, *Earth & Space Science* 7 (2), e2019EA000720.
- J. Razzell Hollis *et al.* (2020) “An Optical Model for Quantitative DUV Raman Spectroscopy on Earth and Mars”, *Appl. Spectrosc.* 74 (6), 684-700.
- H. Sapers *et al.* (2019) “The cell and the sum of its parts: patterns of complexity in biosignatures as revealed by deep UV Raman spectroscopy”, *Frontiers in Microbiology* 10, 679.
- S. Wood, J. Razzell Hollis & J.-S. Kim (2017) “Raman spectroscopy as an advanced structural nanoprobe for conjugated molecular semiconductors”, *J Phys. D: Appl. Phys.* 50 (7), 73001.

J. Razzell Hollis et al. (2014) "Photochemical stability of high efficiency PTB7:PC₇₀BM solar cell blends", *J. Mater. Chem. A* 2, 20189–20195.

Selected Scientific Presentations:

2022 American Astronomical Society, Division of Planetary Sciences 53 – Salt Lake City, USA

Invited Oral Presentation: “First SHERLOC Results from Mars 2020's Green Zone Campaign in Jezero Crater” – cancelled due to COVID-19

2021 California Institute of Technology – Pasadena, USA

Invited Seminar: “Raman Spectroscopy for Planetary Science: Searching for Signs of Life on Mars”

2020 Lunar and Planetary Sciences Conference – USRA, Houston, USA

Oral Presentation: “In-Situ Alteration of Organic Biosignatures in Perchlorate-Spiked Martian Regolith Analog” – cancelled due to COVID-19

2019 American Geophysical Union Fall Meeting – San Francisco, USA

Poster Presentation: “In-Situ Alteration of Organic Biosignatures in Perchlorate-Spiked Martian Regolith Analog”

Poster Presentation: “Raising Visibility: Materials for LGBT+ Diversity and Inclusivity in STEM”

2019 Oxford University, Imperial College London, University College London – UK

Invited Seminar: “Raman Spectroscopy for Planetary Science: Searching for Signs of Life on Mars”

2019 Lunar and Planetary Sciences Conference – USRA, Houston, USA

Poster Presentation: “Quantitative DUV Raman Analysis for Detecting Organic Biosignatures”

2016 Centre for Plastic Electronics Annual Lecture – London, UK

Oral Presentation: “Probing Interfacial Properties with SERS”

2016 LGBT STEMinar – Sheffield, UK

Oral Presentation: “Organic Photovoltaics: Plastic Power”

2014 International Conference on Organic Electronics – Modena, Italy

Poster Presentation: “Photo-Stability of PTB7:PC70BM Organic Solar Cells”