Christina Louise Smith

Curriculum Vitae

Academic Employment

2015–Present **Postdoctoral Fellow**, York University, Canada.
- Postdoctoral position in planetary sciences, focusing on the atmospheres of Mars and Titan and surface processes on Mars and Pluto.
- Member of the Mars Science Laboratory Curiosity Science Operations Team.
- Technology for (Exo-)Planetary Sciences Fellowship recipient.
- Executive Secretary of the 2017 Canadian Space Agency's Atmospheres' Topical Team.
- Supervisor: Prof. John E. Moores.

2014–2015 **STFC Student Enhancement Program Fellow**, The University of Manchester.
- Six month postdoctoral level research position examining molecular, ionic and elemental abundances within and radiative transfer modelling of evolved stars.
- Supervisor: Prof. Albert A. Zijlstra.

Education

2010–2014 **PhD Astronomy and Astrophysics**, The University of Manchester.
Thesis title: Spectroscopic studies of evolved stars and planetary nebulae
Supervisor: Prof. Albert Zijlstra

2006–2010 **MPhys (Hons) Physics with Astrophysics**, The University of Manchester.
First Class Degree

Research Interests

My research interests comprise of a variety of both observational and simulation-based research, including but not limited to: radiative transfer modelling and observation-based studies of the atmospheres of Mars and Titan, simulating surface processes on Mars and Pluto, Solar System analogues for exoplanetary systems and chemical abundance analyses of evolved stars and planetary nebulae. I am an active member of the Mars Science Laboratory (MSL) Science Operations Team as an Environmental Science Theme Lead and Keeper of the Plan and regularly contribute to planning operations for the Curiosity Rover. Finally, I was also a member of the Canadian Space Agency's Atmospheres' Topical Team and served as Executive Secretary for the team.

Awards

2017 NASA Group Achievement Award: MSL Extended Mission 1 Science and Operations Team

2013 UK National Astronomy Meeting student poster competition: runner up.

2010–2014 Science and Technology Facilities Council PhD Studentship.

2006–2008 Institute of Physics Scholarship.

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Publications & Proceedings

2017 Moores, J. E., **Smith, C. L.**, Toigo, A. D. and Guzewich, S. D., *Penitentes as the origin of the bladed terrain of Tartarus Dorsa on Pluto*, Nature 541, 188-190.

2017 Moores, J. E., **Smith, C. L.**, and Schuerger, A. C., *UV production of methane from surface and sedimenting IDPs on Mars in light of REMS data and with insights for TGO*, Planetary and Space Science v147, p48.

2017 Guzewich, S., Newman, C. E., Smith, M. D., Moores, J. E., **Smith, C.L.** et al., *The vertical dust profile over Gale Crater, Mars*, Journal of Geophysical Research: Planets, v122, 12, p2779.

2017 Moores, J.E., Campbell, C. L., **Smith, C. L.**, and Cooper, B. A., *An Analog Rover Exploration Mission for Education and Outreach*, AAS 49.

2017 **Smith, C. L.**, Moores, J. E., and Schuerger, A. C., *The effect of UV surface flux sheilding by spacecraft geometries*, Lunar and Planetary Science Conference 48, contribution no. 1623.

2017 Moores, J.E., **Smith, C. L.**, Toigo, A.D. and Guzewich, S.D., *Penitentes at Tartarus Dorsa, Pluto*, Lunar and Planetary Science Conference 48, contribution no. 1644.

2017 Cooper, B. A., Modestino, R., **Smith, C. L.**, Moores, J. E., *Characterizations of Martian water-ice cloud crystal geometries from phase functions derived using MARCI image data*, Lunar and Planetary Science Conference 48, contribution no. 1360.

2017 **Smith, C. L.**, Zijlstra, A. A., Gesicki, K. M., and Dinerstein, H. L., *Abundances in Galactic bulge planetary nebulae from optical, ultraviolet and infrared observations*, Monthly Notices of the Royal Astronomical Society, 471, 3, 3008.

2017 Moores, J. E., **Smith, C. L.**, and Campbell, C. L., *Watching the Dust and Clouds Float Lazily by During a Martian Summer*, CMOS Bulletin Volume 45, Number 4.

2016 **Smith, C. L.**, Cooper, B. A., and Moores, J. E., *Possible ground fog detection from SLI imagery of Titan*, ICARUS, 271, 269-278.

2016 **Smith, C. L.**, and Moores, J. E., *Geometric Shielding of Surface Rocks on Mars*, Lunar and Planetary Science Conference 47, contribution no. 1903.

2016 McDonald, I., Zijlstra, A. A., Sloan, G. C., **et al.**, *EU Del: Exploring the onset of pulsation-driven winds in giant stars*, MNRAS, 456, 4542.

2015 McDonald, I., Zijlstra, A. A., Lagadec, E., **et al.**, *ALMA reveals sunburn: CO dissociation around AGB stars in the globular cluster 47 Tucanae*, MNRAS, 453, 4324.

2015 **Smith, C. L.**, Zijlstra, A. A. and Fuller, G. A., *The 89.087 GHz HCN maser in IRAS 15082-4808* in "Why do galaxies care about AGB stars III: A Closer Look in Space and Time", ASP Conference Series 497, pg 317.

2015 **Smith, C. L.** *Spectroscopic studies of evolved stars and planetary nebulae*, PhD Thesis, University of Manchester.

2015 **Smith, C. L.**, Zijlstra, A. A. and Fuller, G. A., *A molecular line survey of a sample of AGB stars and planetary nebulae*, Monthly Notices of the Royal Astronomical Society, 545, 177.

2014 **Smith, C. L.**, Zijlstra, A. A. and Dinerstein, H. L., *Zinc abundances of planetary nebulae*, Monthly Notices of the Royal Astronomical Society, 441, 3161, doi: 10.1093/mnras/stu696.

2014 **Smith, C. L.**, Zijlstra, A. A. and Fuller, G. A., *A new HCN maser in IRAS 15082-4808*, Monthly Notices of the Royal Astronomical Society, 440, 172, doi: 10.1093/mnras/stu309.

2012 **Smith, C. L.**, Zijlstra, A. A. Decin, L. and Lombaert, R., *Modelling CO in the circumstellar envelope of IRAS 15194-5115*, Proceedings of Science: Nuclei in the Cosmos (NIC XII).

Media Relations and Experience

2017 **Broadcast Interview: Seldom Sirius (podcast)**, including description of current research, primarily relating to Pluto and participation in the Mars Science Laboratory Mission.

2016 **Text Interview: Universe Today**. Resulting article: "Hugens spots methane fog on Saturn's moon Titan" for Universe Today, url: https://www.universetoday.com/128224/fog-rolls-surface-titans-south-pole/.

2016 **Text Interview: Discovery News**. Resulting article: "fog detected on surface of Saturn moon Titan" for Discovery News, url: https://www.seeker.com/fog-detected-on-surface-of-saturn-moon-titan-1771099547.html.

2016 **Text Interview: Room.EU**. Resulting article: "fog looms large on Titan" for Room.EU, url: https://room.eu.com/news/Fog_looms_large_on_Titan.

2016 **Text Interview: Phys.org**. Resulting article: "fog on Titan detected by Huygens lander" for Room.EU, url: https://phys.org/news/2016-03-fog-titan-huygens-lander.html.

2016 **Broadcast Interview: York Universe (podcast)**. Description of current and previous research, including the subject of my PhD (stellar compositional studies), and my post-doctoral position (Titan, Mars & participation in the Mars Science Laboratory Rover (Curiosity) Science Operations Team)

Conference Attendance & Contributions as the Presenting Author

2017 Canadian Meteorological and Oceanographic Society Congress 2017 – oral presentation.

2017 Lunar and Planetary Sciences Conference – poster.

2016 National Astronomy Meeting, UK – oral presentation $\times 2$.

2016 CASI ASTRO – oral presentation $\times 2$.

2016 Lunar and Planetary Sciences Conference – poster.

2014 Why do galaxies care about AGB stars III – poster.

2013 UK National Astronomy Meeting – oral presentation & poster.

2012 Nuclei in the Cosmos XII – poster.

2012 UK National Astronomy Meeting – poster.

Professional Memberships

2017 Member of the Canadian Meteorological and Oceanographic Society.

2016 Member of the Canadian Aeronautics and Space Institute.

2012–2016 Fellow of the Royal Astronomical Society.

Proposals

JUNO PSP **Science PI** of a 2018 JUNO Participating Scientist Program proposal. CoI: J. Moores.
Awaiting evaluation.

CSA FAST **Lead author** of a Flight for the Advancement of Science and Technology grant proposal to the CSA. CoIs: J. Moores, K. Strong, J. Whiteway, N. Ghafoor, & T. Dzamba.
$600,000 proposed budget, awaiting evaluation.

VLT **Principal investigator** of two VLT proposals aimed at measuring the abundance of zinc in Galactic planetary nebulae. CoIs: A. A. Zijlstra & H. L. Dinerstein.
20 hours (visitor mode) & 39 hours (service mode).

APEX & OSO **Principal investigator** of a Swedish-ESO proposal to measure $^{12}C/^{13}C$ in a sample of asymptotic giant branch stars using APEX and OSO. CoIs: A. A. Zijlstra & L. Decin.
APEX: 20 hours (service mode) & OSO: 78 hours (visitor mode).

JCMT **Principal investigator** of two JCMT proposals aimed at measuring $^{12}C/^{13}C$ from observations of CN and ^{13}CN in a sample of candidate J-type AGB stars. CoI: A. A. Zijlstra.
7 hours (service mode) & 12 hours (visitor mode).

Data Reduction Experience

Huygens Data calibration and reduction of Side Looking Imager data of the surface of Titan.

Mopra Data reduction of and line identification within broadband submillimeter data (80-120 GHz) using the ATNF Spectral Analysis Package.

VLT Data reduction of medium resolution, $\sim 3.5\mu$m ISAAC infra-red data using the ESO Common Pipeline Library and IRAF.

Herschel Reduction of PACS data using HIPE.

Computer Modelling Experience

Doubling & Adding A plane parallel radiative transfer code, used to model atmospheric scattering of incident radiation on Mars.

PRM-BC An original geometric code, written in Python, to simulate illumination, self-sheilding and reflection of insolation upon two-dimensional representations of penitentes.

GeoCrack An original geometric code, written in Python, to simulate shadowing on rock cracks of a variety of dimensions and orientations on Mars.

Hyperion A 3D radiative transfer code for modelling aerosols, applied to Martian conditions.

Cloudy A static photoionization code, used to examine the ionic abundances of planetary nebulae at a variety of central star temperatures.

ComboCode A code that incorporates both MCMax, a 2D Monte Carlo radiative transfer code, and GASTroNOoM, a spherically symmetric non-LTE radiative transfer code, to accurately model both gas and dust components of an astrophysical environment. This code is being used to analyse CO in the evolved star, II Lup.

NEAT Nebular Empirical Analysis Tool, used to calculate elemental and ionic abundances from optical spectra of planetary nebulae.

DUSTY A code for simulating radiative transport in dusty environments, applied to the circumstellar environments of evolved stars.

Additional Analysis Skills

Abundances Calculation of column densities of a number of molecular species and abundance ratios of isotopes, elements and ions from a variety of data sets.

Optical Depth Calculation of optical depths from both spectroscopic and imaging observations.

Variability Construction of light curves using literature photometry data.

Computing Skills

Languages **Advanced:** Python, LaTeX, IDL.
Intermediate: MatLab, Bash.
Basic: HTML, C/C++.

Languages

English **First language**

French **Intermediate**

Teaching Experience

Oct 2016 **Guest Lecturer** for 2×1.5 hr 3rd year undergraduate lectures in Planets and Planetary Systems.

Jun 2016 **Lecturer** for a one hour introductory lecture on planetary sciences for the Integrating Atmospheric Chemistry and Physics from Earth to Space Summer School.

Nov 2015 **Guest Lecturer** for 2×1.5 hr 4th year undergraduate lectures in Fluid Dynamics.

Nov 2015 **Guest Lecturer** for 2×1.5 hr 3rd year undergraduate lectures in Planets and Planetary Systems.

Sept 2012 – Apr 2014 **Teaching Assistant**: demonstrator in weekly problem solving classes of 50–75 first year undergraduate students, covering mathematics, dynamics, electromagnetism and solid state physics. Demonstrators assist the students with problems and explain concepts in detail.

Dec 2012 – Jan 2013 **Tutor**: one-to-one tuition of a foundation year engineering student in various topics in physics and mathematics.

Jan 2012 – Mar 2012 **Laboratory Demonstrator**: co-supervising six third year undergraduate students with an optical astronomy laboratory project. This included assisting in the data collection, reduction and analysis, as well as having involvement in the final assessment process.

Sept 2010 – Jul 2011 **Tutor**: weekly tutoring of five first year undergraduate students in Mathematics, Solid State Physics and Electricity & Magnetism.

Public Outreach Experience

April 2017 **Interviewee** on Seldom Sirius, an astronomy podcast.

March 2017 **Speaker** at Toronto's Solar System Social event.

April 2016 **Speaker** at the Royal Astronomical Society of Canada (Toronto) speaker's night.

2016–present **Host** of York Universe, a live astronomy and astrophysics radio show broadcast on Astronomy fm.

Jan 2012 – Sept 2013 **Executive Producer** of The Jodcast (www.jodcast.net), an outreach astronomy podcast with more than 5000 listeners, produced by students and staff at Jodrell Bank. The role included coordinating volunteers, planning future shows, organising interviews with academics and arranging recruitment and training of new volunteers.

Sept 2010 – Present **Jodcast Volunteer**: producer, editor, presenter and interviewer for The Jodcast astronomy podcast.

Sept 2010 – Present **Outreach Volunteer** at a variety of single-day outreach events to promote science and astronomy to the general public.