

# Euromlanet TA Report

Please see Annex 1 below

Infrastructure short name	Installation ID	Installation short name
Distributed Planetary Simulation Facility (DPSF)	TA2-4	CSS

## PROJECT LEADER – APPLICANT 1

<b>Project number: 11347 / 17-EPN3-081</b>		
<b>Name: Jacqueline Campbell</b>		
<b>Home Institution full address:</b> UCL Mullard Space Science Laboratory, Holmbury Hill Rd, Dorking, RH5 6NT		
<b>Country: United Kingdom</b>		
<b>Legal Status* UNI</b>		
*UNI (University and other higher education organisations) RES (Public research organisation (including international research organisation as well as private research organisation controlled by a public authority) SME , PRV (Other Industrial and/or profit Private organisation) or OTH		
<b>Tel: +44 (0)1483 204256</b>	<b>Fax: +44 (0)1483 278312</b>	<b>E-mail: Jacqueline.campbell.16@ucl.ac.uk</b>
<b>Gender: F</b>	<b>Year of birth: 1982</b>	<b>Group Leader Y/N</b>
<b>New user: Y</b>	<b>Number of visits: 1</b>	<b>Nationality: British</b>
<b>Affiliation: UCL/MSSL</b>	<b>Researcher Status: PGR</b>	<b>Activity Domain* Earth Sciences &amp; Environment</b>

## CO - APPLICANT – if applicable

<b>Name:</b>		
<b>Home Institution:</b>		
<b>Tel:</b>	<b>Fax:</b>	<b>E-mail:</b>
<b>Gender: M/F</b>	<b>Year of birth:</b>	<b>Group Leader Y/N</b>
<b>New user: Y/N</b>	<b>Number of visits:</b>	<b>Nationality:</b>
<b>Affiliation:</b>	<b>Researcher Status: UND / PGR / PDOC / EXP / TEC</b>	<b>Scientific background:</b>

*\*Please select the most appropriate description from the list below:*

Physics	Chemistry	Life Sciences & Biotech	Earth Sciences & Environment
Mathematics	Energy	Material Sciences	Engineering & Technology
Social Sciences	Humanities	Information & Communication Technology	

*How did you hear about us?*

Website	Advertising email <b>X</b>	Colleague	
Other:-			

**HOST / COLLABORATORS** – This information is required for reporting.

<b>Name:</b>	<b>Affiliation:</b>
Jacqueline Campbell	UCL, Mullard Space Science Laboratory
<b>Start Date of visit</b>	16 October 2017
<b>Finish Date of visit:</b>	20 October 2017
<b>No. of days:</b> Please do not include travel days, this is lab/field access only	5
<b>Host laboratory:</b>	Institut de Planétologie et Astrophysique de Grenoble (IPAG)
<b>Will be Reimbursed</b>	Yes

## Project Title –

### **Laboratory Analysis of Martian South Polar Residual Cap Analogues for Comparison With CRISM Observations for Detection of Organics**

#### **Scientific Report Summary.**

*(plain text, no figures, maximum 250 words, to be included in database and published)*

The aims of the experiments carried out were to generate a diagnostic spectrum for PAHs of astrobiological interest in the context of Mars, to constrain the detectability limit of PAHs in CO<sub>2</sub> ice, and to establish the characteristics of PAH spectral features at wavelengths other than the absorption feature at 3.29 μm, where they might be easier to discern within the CO<sub>2</sub> ice spectrum.

The site of the experiments was the “Cold Surface Spectroscopy” facility (CSS) at Institut de Planétologie et Astrophysique de Grenoble (IPAG) Grenoble, France in order to use the spectro-gonio radiometer and its CarboN-IR environmental cell, which has been specifically developed for studying Martian CO<sub>2</sub> ice.

A series of 5 separate experiments were carried out, and the detectability limit of PAHs was established and diagnostic absorption features for higher concentrations of PAHs were recorded at a number of wavelengths, while the limitations of detecting PAHs in Martian regolith analogue were observed.

## Full Scientific Report on the outcome of your TNA visit

Approx. 1 page

My TA visit at the “Cold Surface Spectroscopy” facility was between 16 and 20 October 2017 (5 full days).

The PAHs used were a mixture of 3 of astrobiological interest: (anthracene, phenanthrene and pyrene) in raw form and mixed into a sample of equal parts of each PAH species. This reflects typical PAH content from Martian meteorite analysis. A Vis-NIR spectrum of this mixture was measured by the CSS team just prior to the TNA visit to help prepare our program.

CO<sub>2</sub> ice samples were created in-situ and mixed in the cold room with PAH to ensure uniform distribution and then analysed at -100°C under a CO<sub>2</sub> atmosphere within the CarboN-IR Environmental Cell using the spectro-gonio radiometer SHINE. A full experimental protocol has been developed to optimize the mixing and minimize the H<sub>2</sub>O ice contamination.

Bidirectional reflectance spectra (at single geometry) on both full Vis-NIR and partial spectral ranges were recorded to reflect regions of interest for later comparison to observational results from orbital sensors.

5 samples were analysed between various spectral ranges and at different spectral resolutions for PAHs mixed with CO<sub>2</sub> ice and with Martian soil simulant.

The detectability limit for PAHs in CO<sub>2</sub> was established with reference to levels detected on other planetary bodies, and first tests of the impact of sublimation recorded on the evolution of spectra. Higher concentrations of PAH were also used to record diagnostic features of PAH at various wavelengths in regions less impacted by pure CO<sub>2</sub> spectral features.

A final set of spectra was taken of a PAH mixture in Mars simulant, and of pure Mars simulant.

The results of these novel experiments are extremely useful in allowing the comparison of empirical data with orbital observations from the CRISM instrument on Mars Reconnaissance Orbiter, and establishing the detection limit of PAHs in CO<sub>2</sub> ice, and the limitations of observing PAHs in Martian regolith.

I am a member of the Europlanet Diversity Working Group, and will be attending EPSC 2018 to discuss the results, and use them in outreach materials to encourage women in STEM fields. In future, the results will be used to carry out modelling of end members, to develop machine learning techniques for identification of PAH content in ice, and be incorporated into a PhD thesis.

I would very much like to apply for a further TA visit to IPAG to carry out further experiments to assess the characteristics of PAHs in dust and ice mixtures, as one week was not sufficient time to prepare and study additional samples.

**- Publications arising/planned (include conference abstracts)**

A short paper outlining the results of the experiments is planned for submission to a journal in 2017, and the results will also be presented at ESTEC, Netherlands for the ESLAB Extreme Habitable Worlds Symposium, the first British Planetary Science Congress and the UK Planetary Forum Early Career meeting in the UK, all in December 2017.

**- Host approval** The host is required to approve the report agreeing it is an accurate account of the research performed.

The two managers of the facility, Bernard Schmitt (CNRS/IPAG, Grenoble), and Pierre Beck (UJF/IPAG, Grenoble), approve the report and agree that it is an accurate account of the research performed during the visit of the Cold Surface Spectroscopy facility (DPSF/CSS/TA2-4).

**Annex 1**

<i>Access provider short name</i>	<i>Short name of infrastructure</i>	<i>Installation</i>		<i>Installation Country code</i>
		<i>ID</i>	<i>Short name</i>	
INTA	PFA	TA1-1	Rio Tinto	ES
IRSPS	PFA	TA1-2	Ibn Battuta	IT
Matis	PFA	TA1-3	Iceland	IS
INTA	PFA	TA1-4	Tirez Lake	ES
IRSPS	PFA	TA1-5	Danakil	IT
DLR	DPSF	TA2-1	PEL	DE
MUG	DPSF	TA2-2	IMRF	AT
AU	DPSF	TA2-3	PEF	DK
<b>CNRS</b>	<b>DPSF</b>	<b>TA2-4</b>	<b>CSS</b>	<b>FR</b>
UJF	DPSF	TA2-4(8)	CSS – 3 <sup>rd</sup> party	FR
VUA	DPSF	TA2-5	HPHT	NL
OU	DPSF	TA2-6	LMC	GB
NHM	DPSF	TA2-7	PMCF	GB
VUA	DAFS	TA3-1	GGIF	NL
CNRS	DAFS	TA3-2	HNIF	FR
CNRS	DAFS	TA3-3	SRIF	FR
OU	DAFS	TA3-4	HS50L	GB
OU	DAFS	TA3-5	LFS	GB
OU	DAFS	TA3-6	CSSIA	GB
WWM	DAFS	TA3-7	RNTSI	DE
CNRS	DAFS	TA3-8	IPF	FR