



15817 - The chemical diversity of planetary cores

Cycle: 27, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Carl Melis (PI) (Contact)	University of California - San Diego	cmelis@ucsd.edu
Dr. Patrick Dufour (CoI) (CSA Member)	Universite de Montreal	dufourpa@astro.umontreal.ca
Dr. Beth Klein (CoI)	University of California - Los Angeles	kleinb@astro.ucla.edu
Prof. Ben M. Zuckerman (CoI)	University of California - Los Angeles	ben@astro.ucla.edu
Dr. Siyi Xu (CoI)	Gemini Observatory, Northern Operations	sxu@gemini.edu
Dr. Alycia J. Weinberger (CoI)	Carnegie Institution of Washington	alycia@dtm.ciw.edu

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) GAIAJ0707-7438	COS/FUV COS/NUV	1	28-Oct-2019 13:00:16.0	yes
02	(2) GAIAJ0649-7624	COS/FUV COS/NUV	1	28-Oct-2019 13:00:17.0	yes

2 Total Orbits Used

ABSTRACT

White dwarf stars are now known to regularly accrete material from their extant planetary systems. We have identified two new polluted white dwarf star that are accreting extremely iron-rich material, suggesting that they are being polluted by the core of a massive, differentiated rocky body. We propose COS FUV spectroscopic observations of these two stars that will allow us to peer into the heart of Earth-like rocky exoplanets and explore

the range of elemental compositions they may have. These observations will address questions pertaining to terrestrial planet structure and formation processes and the question of what mixture of elements is responsible for Earth's under-dense outer core.

OBSERVING DESCRIPTION

Our primary goal is to confirm the Fe-rich nature of GaiaJ0707-7438 and GaiaJ0649-7624 and simultaneously ensure that the Fe originates from an O-poor core-like environment. Our secondary goal is then to characterize additional elements. Modeling of absorption lines shows that the desired elements can be measured or sufficiently strongly constrained with observations in the 1130-1433 Angstrom range. We will perform medium spectral resolution ultraviolet spectroscopy with COS and the G130M grating to cover the 1130-1433 Angstrom range. In accordance with the COS2025 policies, we will only use two FP-POS positions (3 and 4).

For the UV flux levels of each white dwarf star (given in their target information areas) it should be possible to obtain average S/N~30 in the 1130-1433 Angstrom wavelength range with total on-source exposure time of approximately 2,500 seconds. These estimates are made using the COS ETC assuming standard background parameters and with a white dwarf spectral energy distribution matched to the parameters and flux level of our target. A signal-to-noise ratio of ~30 for the 1130-1433 Angstrom wavelength range will enable detection or tight limits on the abundances of oxygen and iron. Such a signal-to-noise ratio will also enable the detection or constraint of other elements (e.g., carbon, aluminum, phosphorus, sulfur, chromium, manganese, or nickel). Our requested time estimates for COS are increased assuming 20 minutes of instrument overhead (including all acquisition and exposure overheads as suggested in the COS manual) per visit and 6 minutes of observatory overhead per orbit (spacecraft acquisition). In sum, we request 1 orbit for each white dwarf (separate visits) and a total of 2 orbits for this project.

Observations will be done in the TIME-TAG mode using TAG-FLASH wavelength calibration.

Each white dwarf is an ICRS object (Gaia DR2 position with less than 0.4" positional uncertainty), has a measured UV flux, and is safe for the COS detectors in our desired setups.

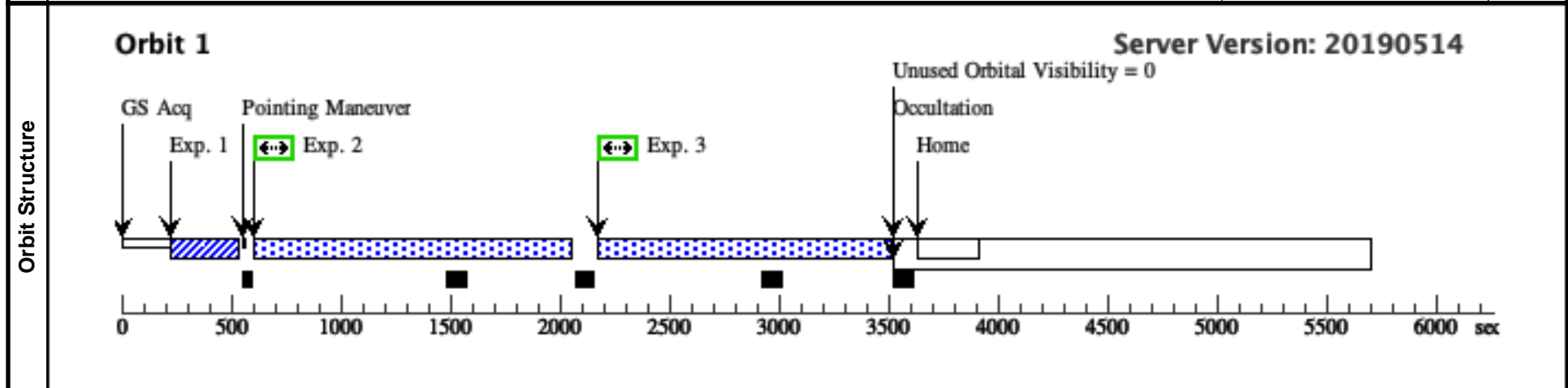
Proposal 15817 - GaiaJ0707-7438 (01) - The chemical diversity of planetary cores

Mon Oct 28 17:00:18 GMT 2019

Visit	Proposal 15817, GaiaJ0707-7438 (01), scheduling				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: COS/FUV, COS/NUV				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	GAIAJ0707-7438	RA: 07 07 54.8448 (106.9785200d) Dec: -74 38 27.91 (-74.64109d) Equinox: J2000	Proper Motion RA: -68.076 mas/yr Proper Motion Dec: -24.394 mas/yr Parallax: 0.017" Epoch of Position: 2015.5	V=14.95+/-0.06 mFUV=14.65+/-0.01, mNUV=14.77+/-0.01	Reference Frame: ICRS
	<i>Comments:</i>					
	Category=STAR Description=[DA] Extended=NO					

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.137 0469)	(1) GAIAJ0707-7438 8	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				42 Secs (42 Secs) [==>]	[1]
	2	(COS.sp.137 1633)	(1) GAIAJ0707-7438 8	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=72 0; FP-POS=3; FLASH=YES			1280 Secs (1280 Secs) [==>]	[1]
	3	(COS.sp.137 1633)	(1) GAIAJ0707-7438 8	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=72 0; FP-POS=4; FLASH=YES			1288 Secs (1288 Secs) [==>]	[1]



Proposal 15817 - GaiaJ0649-7624 (02) - The chemical diversity of planetary cores

Mon Oct 28 17:00:18 GMT 2019

Visit	Proposal 15817, GaiaJ0649-7624 (02), scheduling				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: COS/FUV, COS/NUV				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(2)	GAIAJ0649-7624	RA: 06 49 34.8524 (102.3952183d) Dec: -76 24 58.11 (-76.41614d) Equinox: J2000	Proper Motion RA: -48.064 mas/yr Proper Motion Dec: 123.158 mas/yr Parallax: 0.007" Epoch of Position: 2015.5	V=16.46+/-0.08 mNUV=15.6 (from MSX)	Reference Frame: ICRS
	<i>Comments:</i>					
	Category=STAR Description=[DA] Extended=NO					

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.137 1629)	(2) GAIAJ0649-7624 4	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				10 Secs (10 Secs) [==>]	[1]
	2	(COS.sp.137 1632)	(2) GAIAJ0649-7624 4	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=85 0; FP-POS=3; FLASH=YES			1320 Secs (1320 Secs) [==>]	[1]
	3	(COS.sp.137 1632)	(2) GAIAJ0649-7624 4	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=85 0; FP-POS=4; FLASH=YES			1331 Secs (1331 Secs) [==>]	[1]

