16502 - Bulk abundances of the planetary material in a nearby bright gaseous disk around a white dwarf

Cycle: 28, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) WDJ000545.13+580538.24	COS/FUV COS/NUV	2	14-Apr-2021 10:00:33.0	yes
02	(1) WDJ000545.13+580538.24	COS/FUV COS/NUV	2	14-Apr-2021 10:00:34.0	yes

4 Total Orbits Used

ABSTRACT

The remnants of planetary systems that survived the metamorphosis of their host stars into white dwarfs are identified in the form of compact debris disks, formed from the tidal disruption of planetesimals. These disks are detectable as IR flux excess, and, in rare occasions, as metallic emission lines from a gaseous disk component in optical spectra. These gaseous disks are thought to host embedded solid fragments, maybe the core, of the

disrupted planetesimal, and represent ideal targets for joint ultraviolet, optical and infrared observations that provide unrivalled insight into the formation of these disks, the nature of the disrupting planetesimal, the elemental abundances of the planetary debris, and its mineralogical make-up. Here, we propose COS far-ultraviolet spectroscopy of a new, bright, and nearby gaseous disk system that we identified in December 2020, to measure the elemental abundances of the planetary material. The far-ultraviolet wavelength range is critically important to access transitions of core (Fe, Ni), mantle (Si, Mg, O), and crust (Ca, Al), as well as volatiles (C, N, S, P) species that have no transitions at optical wavelengths, or are contaminated by the disk emission lines. This system is also a prime target for JWST Cycle 2 MIRI spectroscopy of the circumstellar dust, and this mid-cycle program will ensure that the composition of the debris is known well in time for the next JWST proposal round.

OBSERVING DESCRIPTION

The goal of this proposal is to obtain full spectroscopic coverage over ~1100 - 1430A. For this purpose, we will use the G130M grating with two different central wavelengths, 1291A and 1222A. At each central wavelength, we use all available FP-POS settings to mitigate fixed pattern noise.

The target is a single white dwarf, not variable, and an acquisition with NUV imaging using MIRROR-B is safe and efficient.

We split the @1291A and @1222A observations into two separate visits to facilitate the scheduling.

We obtained a Swift ToO UVOT UVW2 observation of the target

https://www.swift.psu.edu/operations/obsSchedule.php?t=14167&perc=1

to establish the UV flux to be 2.1e-14A @ 1928A (see below). The intrinsic spectrum of this white dwarf is close to a blackbody with Teff=20500K, which we adopted for the ETC calculations, scaled to the Swift UVW2 flux.

uvotsource: Source
Position: RA = 00h 05m 45.13s, Dec = +58d 05m 39.0s (J2000)
Position: RA = 1.43806, Dec = 58.09418 (J2000)
Exposure: 654.53 s
Filter: UVW2

Significance: 136.0 sigma (stat)
Background-limit: 3.0 sigma (stat)

uvotsource: UVOT uvw2 magnitude (AB system)
Source: 15.25 +/- 0.02 (stat) +/- 0.03 (sys)
Background: 24.22 arcsec^-2
Background-limit: 21.04
Coincidence-limit: 12.68

uvotsource: Flux density [erg/s/cm^2/A]
Source: 2.08 +/- 0.04 (stat) +/- 0.05 (sys) x 10^-14
Background: 5.41 +/- 0.04 (stat) +/- 0.12 (sys) x 10^-18 arcsec^-2
Background-limit: 1.01 x 10^-16
Coincidence-limit: 2.22 x 10^-13

Visit

Proposal 16502, COS spectroscopy, G130M @ 1291, 1222A (01), implementation Wed Apr 14 14:00:34 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: Only two FP-POS settings allowed for the 1291A central wavelength.

Fixed Targets

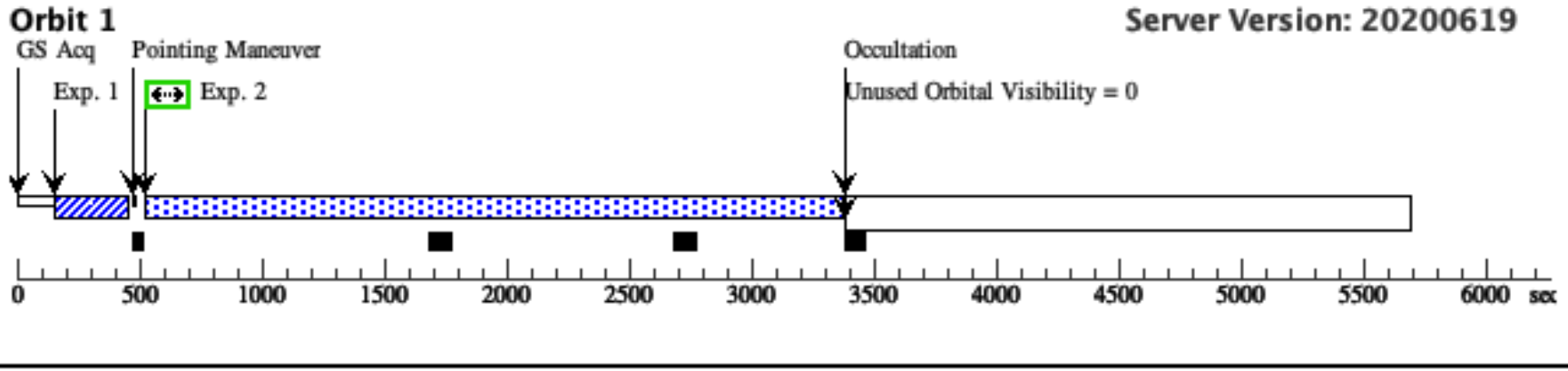
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ000545.13+580538.24	RA: 00 05 45.1323 (1.4380513d) Dec: +58 05 38.24 (58.09396d) Equinox: J2000	Proper Motion RA: 17.424 mas/yr Proper Motion Dec: 17.783 mas/yr Epoch of Position: 2000	V=15.7 Swift uvw2(lambda_eff=1928A) =15.25 AB mag	Reference Frame: ICRS

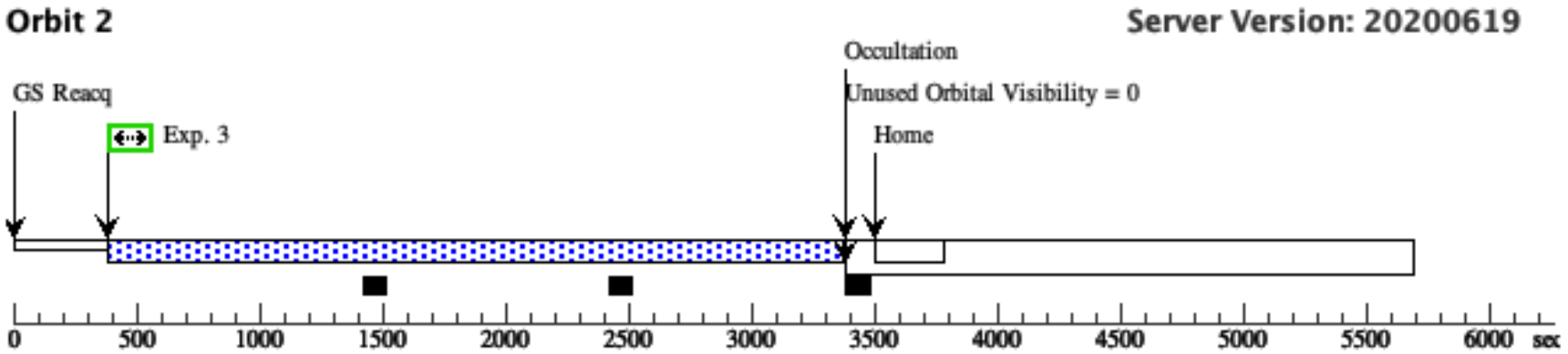
Comments:
Category=STAR
Description=[DB]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ/IMAGE (COS.ta.1486307)	(1) WDJ000545.13+580538.24	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				3 Secs (3 Secs) *[==>]*	*[1]*
2	G130M @ 1291A, FP-POS=3 (COS.sp.1486310)	(1) WDJ000545.13+580538.24	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1000; FP-POS=3			2678 Secs (2678 Secs) *[==>]*	*[1]*
3	G130M @ 1291A, FP-POS=4 (COS.sp.1486310)	(1) WDJ000545.13+580538.24	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1000; FP-POS=4			2933 Secs (2933 Secs) *[==>]*	*[2]*

Orbit Structure





Visit

Proposal 16502, COS spectroscopy, G130M @ 1222A (02), implementation Wed Apr 14 14:00:34 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ000545.13+580538.24	RA: 00 05 45.1323 (1.4380513d) Dec: +58 05 38.24 (58.09396d) Equinox: J2000	Proper Motion RA: 17.424 mas/yr Proper Motion Dec: 17.783 mas/yr Epoch of Position: 2000	V=15.7 Swift uvw2(lambda_eff=1928A) =15.25 AB mag	Reference Frame: ICRS

Comments:
Category=STAR
Description=[DB]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ/IMAGE (COS.ta.1486307)	(1) WDJ000545.13+580538.24	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	G130M @ 1222A, FP-POS=1 (COS.sp.1486309)	(1) WDJ000545.13+580538.24	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1169; FP-POS=1			1279 Secs (1279 Secs) *[==>]*	 ***[1]***
3	G130M @ 1222A, FP-POS=2 (COS.sp.1486309)	(1) WDJ000545.13+580538.24	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1180; FP-POS=2			1279 Secs (1279 Secs) *[==>]*	 ***[1]***
4	G130M @ 1222A, FP-POS=3 (COS.sp.1486309)	(1) WDJ000545.13+580538.24	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1304; FP-POS=3			1414 Secs (1414 Secs) *[==>]*	 ***[2]***
5	G130M @ 1222A, FP-POS=4 (COS.sp.1486309)	(1) WDJ000545.13+580538.24	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1304; FP-POS=4			1414 Secs (1414 Secs) *[==>]*	 ***[2]***

Orbit Structure