16314 - Investigating extreme evolved planetary systems: The hottest white dwarf debris disc

Cycle: 28, Proposal Category: GO

(UV Initiative)

(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) WDJ2100+2122	COS/FUV COS/NUV	1	23-Jun-2020 09:00:16.0	yes

1 Total Orbits Used

ABSTRACT

There is vast evidence establishing the survival of exoplanets through the evolution of their host stars into white dwarfs (WDs). A key signature that betrays the presence of planetary systems around WDs is a compact (~ 1 Solar radius) debris disc, formed from the tidal disruption of planetesimals and detectable as an infrared flux excess. These discs accrete onto the WDs polluting their otherwise pristine H or He atmospheres, and the analysis

of adequate optical and UV spectroscopy of these systems allows reconstruction of bulk composition of the disrupted planetesimals.

A rare subset of debris discs host gas that can be observed through double-peaked emission profiles, tracers of "fresh" disruption events which provide dynamical and geometric information on the disc. In a search for debris disc hosts we have identified the gaseous debris disc host, WD J2100+2122. The WD has an effective temperature of 26760 K, making it by far the hottest gaseous debris disc host known to date and challenges the standard model of debris discs. The emission profiles from the disc are unusual; where all known gaseous debris discs are dominated by the 860nm Ca triplet emission, the spectrum of WD J2100+2122 exhibits an array of Fe emission features.

The peculiar emission features can either be explained by (i) the high temperature of the WD heating the disc and thereby changing the line strengths, or (ii) the composition of the accreted body being Fe-enhanced/Ca-depleted. To determine the correct scenario, we require a single orbit of COS spectroscopy to fully characterise the elemental abundance of the accreted planetesimal using the plethora of absorption lines available in the FUV.

OBSERVING DESCRIPTION

We wish to observe the target WD2100+2122 for a single orbit, as this is a bright, hot DA white dwarf which has signs of strong metal pollution. We will observe the target in two FUV settings, with central wavelengths 1291 and 1222. We will expose in the 1222 cen wave setting for longer to account for the sensitivity drop off to shorter wavelengths.

Copied below is the techincal description from the submitted proposal.

The main scientific goal of this proposal is to measure the photospheric abundances of the WDJ2100+2122 - polluted by the accretion of a planetary body. This study requires sufficiently high spectral resolution to avoid blending of the individual elements (Figure 3), which would hinder accurate individual abundance determinations. A resolution of ~20000 as offered by the COS 130M grating is ideal for the task, and the instrument provides sufficient sensitivity to carry out the observations with a modest investment of HST time. We will cover the far-ultraviolet (FUV) part of the spectrum with one orbit of COS G130M observations, with two central wavelength settings of 1222A and 1291A with an effective wavelength coverage 1080-1430A. These central wavelengths were chosen to cover a large range of potential photopsheric lines that can be used to determine the composition of the debris disc.

As our aim is to determine the photopsheric abundance of the white dwarf, we require a S/N >= 30, which has been used successfully in previous

polluted white dwarf studies. Using our model spectrum as input for the Exposure Time Calculator, we find that we reach this S/N in ~750s on-target exposure time for the 1291A central wavelength setting. We will obtain an exposure of the same length using the 1222A central wavelength setting, with a combined time of 30 mins which is well within the estimated visibility of the target of ~ 53mins even including overheads for guide star acquisition, target acquisition, and detector readout. Any excess time will be used to obtain an additional exposure in the 1222A central wavelength setting to increase the S/N in the wavelength range 1080-1120 A.

Visit

Proposal 16314, Visit 01

Tue Jun 23 13:00:16 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ2100+2122	RA: 21 00 34.7303 (315.1447096d) Dec: +21 22 57.48 (21.38263d) Equinox: J2000	Proper Motion RA: 73.72497272968835 mas/yr Proper Motion Dec: 38.423205235586295 mas/yr Epoch of Position: 2015.5	V=15.2 GALEX FUV = 13.80	Reference Frame: ICRS

Comments:
Category=STAR
Description=[ACCRETION DISK, DA, EXTRA-SOLAR PLANETARY SYSTEM]
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.1447399)	(1) WDJ2100+2122	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				17 Secs (17 Secs) *[==>]*	*[1]*
2	(COS.sp.1449864)	(1) WDJ2100+2122	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=235; FP-POS=2			590 Secs (590 Secs) *[==>]*	*[1]*
3	(COS.sp.1449864)	(1) WDJ2100+2122	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=235; FP-POS=3			590 Secs (590 Secs) *[==>]*	*[1]*
4	(COS.sp.1449865)	(1) WDJ2100+2122	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=240; FP-POS=3			350 Secs (350 Secs) *[==>]*	*[1]*
5	(COS.sp.1449865)	(1) WDJ2100+2122	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=240; FP-POS=4			350 Secs (350 Secs) *[==>]*	*[1]*

Orbit Structure