



14448 - Accurate Mass Determination of the Nearby Old White Dwarf Stein 2051B through Astrometric Microlensing

Cycle: 23, Proposal Category: GO/DD

(Availability Mode: AVAILABLE)

INVESTIGATORS

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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	(2) STEIN-2051B-SOURCE	WFC3/UVIS	1	01-Oct-2015 22:27:19.0	yes

1 Total Orbits Used

ABSTRACT

We request one orbit of WFC3 imaging of the nearby white dwarf (WD) Stein 2051B. In 2014 March, this WD passed very close to a faint background star, affording the opportunity to measure the relativistic deflection of its apparent position and thus determine the mass of the WD--the first application of this novel technique to the measurement of a stellar mass. We were awarded 7 orbits of HST time for WFC3 astrometry of the event. The deflection is clearly detected (at >3 sigma) in 3 of the epochs. Unfortunately, at the other 4 epochs, the background star (400 times fainter than the WD) was extremely close to the WD (inside the second Airy ring). In spite of strenuous efforts at PSF subtraction by our expert CoI, we have been unable to achieve high astrometric accuracy at these 4 epochs. Using only the 3 measured deflections, there is an ambiguity, resulting in two possible masses. One solution, at 0.71

Msun, is consistent with physical models for a CO-core WD, but the other, at 0.52 Msun, would imply an iron core. The latter would be inconsistent with most of our WD-formation theories, but oddly enough agrees with a ground-based mass derived by Strand in the 1980's based on an analysis of differential proper motions. Fortunately, the deflection is still detectable until ~2015 November, and as a bonus will now be in a different direction relative to the proper motion of the source. Thus one more observation, if taken before 2015 December, will both remove the ambiguity between the two mass solutions, and reduce the error bar on the correct mass. Hence we propose one orbit of DD time, to be obtained before 2015 December.

OBSERVING DESCRIPTION

This is a continuation of our program 13850.

Since

- (I) proper motions of the source and reference stars have the largest uncertainty at this point,
- (ii) there is a clear science gain if we measure the position of the red dwarf with respect to the WD,
- (iv) the source is ~90 pixels away from the WD,

we plan to observe in 2kx2k mode in F814W, so that we can have the maximum number of reference stars. We will take ~2 additional short exposures in F763M to get the position of the red dwarf.

Proposal 14448 - Visit 01 - Accurate Mass Determination of the Nearby Old White Dwarf Stein 2051B through Astrometric Microlensing

Fri Oct 02 02:27:20 GMT 2015

Visit	Proposal 14448, Visit 01, scheduling Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 255D TO 255 D; BETWEEN 08-OCT-2015 AND 16-OCT-2015; VISIBILITY INTERVAL 56 M Comments: <i>ORIENT constraints are used to avoid diffraction spikes and bleed columns from Stein 2051A and B falling near the faint source star.</i>									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(2)	STEIN-2051B-SOURCE	RA: 04 31 15.0090 (67.8125375d) Dec: +58 58 13.17 (58.97032d) Equinox: J2000		V=12.45	Reference Frame: ICRS			
	Comments: <i>This object was generated by the targetselector and retrieved from the SIMBAD database.</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=12; BLADE=A	POS TARG 10.4,9	Sequence 1-10 Non-Int in Visit 01	1 Secs (1 Secs) [==>]	[1]
	2	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=6	SAME POS AS 1	Sequence 1-10 Non-Int in Visit 01	240 Secs (240 Secs) [==>]	[1]
	3	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=12	POS TARG 15.4,14	Sequence 1-10 Non-Int in Visit 01	1.0 Secs (1 Secs) [==>]	[1]
	4	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=6	POS TARG 15.4,14	Sequence 1-10 Non-Int in Visit 01	240 Secs (240 Secs) [==>]	[1]
	5	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F763M	FLASH=12	POS TARG 5.4,14	Sequence 1-10 Non-Int in Visit 01	0.5 Secs (0.5 Secs) [==>]	[1]
	6	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=6	SAME POS AS 5	Sequence 1-10 Non-Int in Visit 01	240 Secs (240 Secs) [==>]	[1]
	7	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=12	POS TARG 5.4,4	Sequence 1-10 Non-Int in Visit 01	1.0 Secs (1 Secs) [==>]	[1]
	8	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=6	POS TARG 5.4,4	Sequence 1-10 Non-Int in Visit 01	240 Secs (240 Secs) [==>]	[1]
	9	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F763M	FLASH=12	POS TARG 15.4,4	Sequence 1-10 Non-Int in Visit 01	0.5 Secs (0.5 Secs) [==>]	[1]
	10	(2) STEIN-2051B-SOURCE	STEIN-2051B-SOURCE	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F814W	FLASH=6	POS TARG 15.4,4	Sequence 1-10 Non-Int in Visit 01	240 Secs (240 Secs) [==>]	[1]

