15420 - The first compact massive lens galaxy in the Kilo Degree Survey

Cycle: 25, 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) KIDSJ0236-3215	WFC3/UVIS	1	08-Jan-2018 11:16:48.0	yes
02	(1) KIDSJ0236-3215	WFC3/UVIS	1	08-Jan-2018 11:16:49.0	yes

2 Total Orbits Used

ABSTRACT

Compact massive galaxies, old systems with sizes <3kpc and masses >~10^11 solar masses, are believed to be the local counterparts of the so-called high-z red nuggets that, for unknown reasons, have missed the channels of galaxy size growth and therefore are unique systems to test the two-phase formation scenario and to understand how structures in the Universe have formed and evolved. A crucial ingredient to shed light on galaxy formation is to properly understand how their dark and stellar components have interacted and settled in their current density profiles. Gravitational lensing is a

unique probe to address these questions. By modelling the arc features around massive galaxies, one can determine the total mass and density profile with unprecedented precision, unachievable in any other way. Combining also dynamics and/or stellar population analysis from spectroscopical data, one can disentangle luminous from DM and constrain in this way the shape of the stellar Initial Mass Function (IMF), the internal dark matter fractions, the light and mass density slopes. Within the Public ESO Kilo Degree Survey, we discovered a very compact massive lens galaxy. This object is unique and we request HST data to 1) unambiguosly confirm the its lens nature 2) properly model the lens and source to get very precise estimation of the lens total mass 3) study the light and mass distribution and put contraints on the internal DM fraction as well as on the IMF slope, complementing HST data with ground-based spectroscopy already in hand.
We request only 2 orbits, one for the caracterization of lens (with WFC3-F814W) and one for that of the source (with WFC3-F390W) to achieve our goals.

OBSERVING DESCRIPTION

The goal of this proposal is to obtain a high resolution image of the lens and the source of the first strong gravitational lens candidate we found in the KiDS Survey: KiDS J0236-3215, with high signal-to-noise and optimal spatial resolution. In fact, spatial resolution is crucial to resolve the arc structure and perform a detailed lensing analysis, this is why we choose the WFC3 instrument in virtue of its small pixel size.
In order to clearly separate the source from the lens, we require two HST bands (one orbit for each of them): F390W which will give us the best contrast between source and lens, and will hopefully make the counter image of the source visible, and F814W which will allow a more robust determination of the stellar distribution of the lens, necessary for the dynamical analysis and the study of the IMF.
Our observations will therefore be splitted into two identical orbits, one with the F390W filter and the second with the F814W filter. We also applied a small offset of the pointing (POSTARG: x=4, Y=14) from the lens system to ensure that at any rotation angle the system will not fall into the gap between the two detectors.
For each orbit, we have planned a dithering box pattern with a set of 4 exposures of 620 seconds on target. Using this dither strategy we change the placement of hot pixels on the field, to improve sampling of the PSF, and to reduce the impact of errors in the pixel-to-pixel flats. With four sub-exposures the fraction of overlapping cosmic ray hits is almost null. The exposure time, including readouts and overhead are the following:
333 sec (guide star acquisition) + 116 sec x 3 (overhead) + 4 exp x (620 sec on target + 12 sec overhead) for a total of 53.4 minutes, well within the one orbit limit.
This strategy optimizes the total time on target, saving the buffer dumping of the sub-exposures which are done in parallel with the subsequent one.
Moreover, using the WFC3 ETC we predict that 2500 sec of exposure time in the F390W will provide us with a detection of the arc at S/N~10 per pixel. In this filter the lens contribution will be much smaller, and this will allow us to detect the counter-image of the source. Similarly, the lens will

be detected at S/N> 50 in the center with the F814W filter where the main arc from the source will nevertheless be visible.

In summary, we request ~2500 seconds on target with HST WFC-F390W (to get the best contrast between source and lens) and ~2500 seconds on target with WFC-F814W (to get an accurate characterization of the redder lens light distribution), so, one orbit for each filter, to achieve very important astrophysical and cosmological goals.

Visit

Proposal 15420, Visit 01, implementation Mon Jan 08 16:16:50 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX	Coordinate Frame=POS-TARG		(1)
	Purpose=DITHER	Pattern Orientation=23.884		
	Number Of Points=4	Angle Between Sides=81.785		
	Point Spacing=0.173	Center Pattern=false		
	Line Spacing=0.112			

Fixed Targets

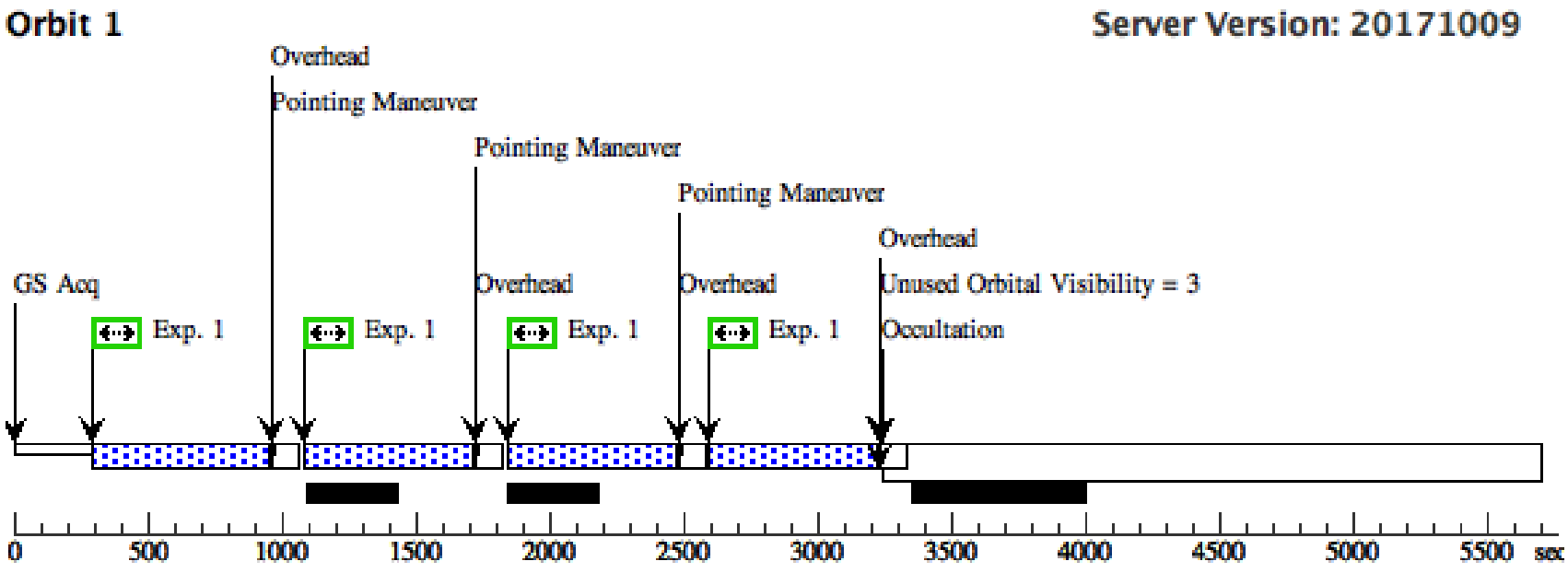
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	KIDSJ0236-3215	RA: 02 36 23.7462 (39.0989425d)	Redshift: 0.4	V=(?)	Reference Frame: WCS fk5
		Dec: -32 04 50.87 (-32.08080d)		19.8 from KiDS r-band (lens)	
		Equinox: J2000			

Comments: Probable Lens galaxy with a star-forming galaxy as lensed source
Category=GALAXY
Description=[ELLIPTICAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) KIDSJ0236-3215	WFC3/UVIS, ACCUM, UVIS2	F814W		POS TARG 4,15	Pattern 1, Exps 1-1 in Visit 01 (1)	628 Secs (2512 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	
								[==>(Pattern 3)]	
								[==>(Pattern 4)]	

Orbit Structure



Visit

Proposal 15420, Visit 02, implementation Mon Jan 08 16:16:50 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX	Coordinate Frame=POS-TARG		(1)
	Purpose=DITHER	Pattern Orientation=23.884		
	Number Of Points=4	Angle Between Sides=81.785		
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Comments: Probable Lens galaxy with a star-forming galaxy as lensed source
Category=GALAXY
Description=[ELLIPTICAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) KIDSJ0236-3215	WFC3/UVIS, ACCUM, UVIS2	F390W	FLASH=7	POS TARG 4,15	Pattern 1, Exps 1-1 in Visit 02 (1)	628 Secs (2500 Secs)	
								[==>625.0 Secs (Pattern 1)]	***[1]***
								[==>625.0 Secs (Pattern 2)]	
								[==>625.0 Secs (Pattern 3)]	
								[==>625.0 Secs (Pattern 4)]	

Orbit Structure