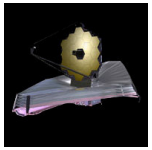

6207 - Testing CDM: The Dark Matter Mass Function Below 10^9 Solar Masses

Cycle: 3, Proposal Category: GO

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRCam Imaging	(1) ACT-CL-J0437.1+0043

ABSTRACT

Cosmological simulations of cold dark matter robustly predict a hierarchy of low mass (<10^9Msun) substructures. These do not form stars, so the prediction has never been tested. Moreover, the substructures are smoothed away in simulations of any other form of warm/interacting/fuzzy dark matter.

We propose imaging of galaxy cluster RXJ0437+00 (z=0.285). Uniquely, this hosts 'Hyperbolic-Umbilic' strong gravitational lensing of three galaxies at z=2, 3 and 6. This exotic lens configuration is rare (two years ago, only one was known, but MUSE has now found ~12). Unlike normal gravitational lensing, multiple images of background galaxies are magnified isotropically and away from contamination by foreground lens light. This system is sensitive to >10^7.5Msun substructures along the lines of sight to any image, which would appear additionally distorted. HST observations have proved feasibility of this technique, but are sensitive to only 10^9Msun substructures.

We expect to detect ~2 dark matter perturbers if the universe contains CDM (the first confirmation of this prediction), but none if the universe contains WDM. For free, star forming regions in the high redshift galaxies will be magnified by ~200x for an isotropic resolution of ~100pc.

OBSERVING DESCRIPTION

We propose to obtain multi-band NIRCAM imaging of the strong gravitational lensing cluster RX J0437+00 (z = 0.285). Specifically, we will image the cluster in four broad bands (F090W, F200W, F277W, and F444W) in order to measure the properties of several rare, "exotic" hyperbolic-umbilic lens systems found within the dense core. To reduce data volume, we will only need to activate NIRCAM Module B. Furthermore, thanks to the compact nature of the cluster, we can fit all of our targets simultaneously into a single short-wavelength FPA chip. Nevertheless, we will still apply an INTRAMODULEBOX 4 primary dither pattern during data acquisition; this will remove the chip gap in the final image mosaic, providing nearly uniform imaging depth in the cluster's strong lensing region. We will also apply a 4-point subpixel dither patern to the obervations, to better characterize the shape of the instrument PSF. With our combination of imaging and filter selection, our targets will reach a SNR ~ 100 (the required SNR for our science case) in just under 2 hours in all four selected bands.

Proposal 6207 - Targets - Testing CDM: The Dark Matter Mass Function Below 10^9 Solar Masses

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	ACT-CL-J0437.1+0043	RA: 04 37 9.5341 (69.2897254d) Dec: +00 43 51.95 (.73110d) Equinox: J2000	Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Clusters of Galaxies
Description=[Einstein rings]

Observation

Proposal 6207, Observation 1

Fri Dec 13 22:00:42 GMT 2024

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Diagnostics

(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	ACT-CL-J0437.1+0043	RA: 04 37 9.5341 (69.2897254d) Dec: +00 43 51.95 (.73110d) Equinox: J2000	Epoch of Position: 2000	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Clusters of Galaxies
Description=[Einstein rings]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEBOX	4	SMALL-GRID-DITHER		4

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W	F444W	SHALLOW4	10	1	16	16	8417.628	172195
2	F200W	F277W	SHALLOW4	5	1	16	16	4122.92	172195

Special Requirements

Offset 38.83 arcsec, 38.23 arcsec