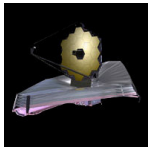

9371 - Stellar Initial Mass Function and Dark Matter from [OII] and Paschen-alpha Emission Maps Of the Giant Dragon Arc in the Hubble Frontier Fields Galaxy Cluster Abell 370

Cycle: 4, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
Observation Folder				
	1		NIRCam Imaging	(3) ABELL370

ABSTRACT

The ~30 arcsecond Dragon arc at z=0.72 created by the Abell 370 cluster is the most prolific known source of microlensing events of individual stars at a cosmological distance. A total of ~50 stars have been detected across only two ultra-deep UV-optical HST and two shallow JWST visits. Recent work finds that the observed microlensing events may exhibit a broad bias towards the negative-parity side of the critical curve, which holds the

promise to distinguish among forms of substructure produced by different dark-matter candidates. Improved constraints on the location of the cluster's critical curve, however, are needed. Furthermore, the microlensing events, if they can be combined with a spatially resolved recent star-formation history, will yield constraints on the upper-end of the initial-mass function (IMF) across the giant arc.

Here we propose to take advantage of a pair of coincidences between the WFC3 UVIS F645N filter and [OII] nebular emission from the Dragon arc at z=0.72, and between the JWST NIRCam F323N filter and Paschen alpha emission (Primary HST ID: 6545). Since nebular emission is not, as a rule, found at the same locations as star-forming clumps visible in broadband images, the proposed data yield a new and independent set of constraints on the path of the critical curve. Pairs of counterimages of HII regions identified by their [OII] / Paschen alpha ratio will precisely bracket the location of the critical curve. Moreover, the fluxes of HII regions should not be affected by stellar microlensing, so we can, for the first time, unambiguously detect the existence of millilensing due to dark-matter subhalos in a cluster.

OBSERVING DESCRIPTION

In the accompanying proposal submitted to the HST telescope allocation committee, we describe the proposed WFC3 UVIS F645N observations of [OII] nebular emission from the giant Dragon arc at z=0.725 in the Abell 370 galaxy-cluster field. Here we provide a description of the proposed JWST NIRCam F323N filter observations of the Paschen alpha emission of the same target, as well as coordinated F335M observations. At a redshift of z=0.725, the Paschen alpha emission has an observer-frame wavelength of 3234 Ang, which falls within passband of the narrow F323N filter. We propose for F335M observations acquired during the same visit to enable subtraction of the stellar continuum. Given the high rate of microlensing events which could contribute to both F323N and F335M, coordinated F335M imaging is needed to measure and subtract the continuum accurately. We propose for simultaneous imaging through the F200W and F150W wide-band filters in the Short Wavelength Channel.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	ABELL370	RA: 02 39 54.0850 (39.9753542d) Dec: -01 34 41.76 (-1.57827d) Equinox: J2000		

Comments:
Category=Clusters of Galaxies
Description=[Abell clusters]

Observation

Proposal 9371, Observation 1

Fri Sep 12 17:00:09 GMT 2025

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
(3)	ABELL370	RA: 02 39 54.0850 (39.9753542d) Dec: -01 34 41.76 (-1.57827d) Equinox: J2000		

Comments:
Category=Clusters of Galaxies
Description=[Abell clusters]

Template

Module	Subarray	Target Placement
ALL	FULL	Module B (B4 corner)

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEX	3	STANDARD		2

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	F200W	F323N+F322W2	MEDIUM8	7	1	6	6	4380.602	
2	F115W	F335M	SHALLOW4	4	1	6	6	1223.992	

Special Requirements

Aperture PA Range 63.88744876 to 63.88744876 Degrees (V3 63.83482185 to 63.83482185)
Fiducial Point Override NRCBS_FULL