



## 17508 - HST imaging of a newly discovered many-ringed galaxy

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

### INVESTIGATORS

<i>Name</i>	<i>Institution</i>
<b>Imad Pasha (PI) (Contact)</b>	<b>Yale University</b>
Prof. Pieter van Dokkum (CoI) (Contact)	Yale University
Mr. Tim Blake Miller (CoI)	Yale University

### 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	(1) LEDA1313424	ACS/WFC	2	13-Sep-2023 11:00:35.0	yes

2 Total Orbits Used

### ABSTRACT

We have identified a relatively nearby ( $z \sim 0.039$ ) collisional ring galaxy (CRG), formed by an impulsive impactor with a massive perturber, likely in a head-on collision. This object, dubbed the "Bullseye," is a special case among CRGs: it has not one or two, but as many as seven candidate rings, three of which are confirmed; the existence of so many predominantly symmetric rings indicates we have caught this galaxy in a short ( $\sim$ few hundred Myr) window during its post-impact evolution. Several of the ring candidates both in the interior and at large radii require HST resolution to confirm. Beyond being the best laboratory thus far discovered to test collisional theory, the system also appears to have a low surface brightness component in the outskirts with candidates for star-forming clumps at large radii ( $R \sim 60-75$  kpc). Simulations have suggested that the expansion and fading of collisional rings might produce Giant Low Surface Brightness Galaxies (e.g., Malin I), but this theory has lacked the key transition object displaying strong evidence of both a collision and a low surface brightness disk. Here we propose to obtain F475W and F814W imaging of the system, leveraging the resolution of HST to definitively characterize the small ( $< 0.5''$ ) substructures in the galaxy, confirm whether the emission in

Proposal 17508 (STScI Edit Number: 0, Created: Wednesday, September 13, 2023 at 10:00:36 AM Eastern Standard Time) - Overview  
the outskirts is a faded ring, and investigate candidates for the impactor whose collision produced the ring structure in the system. If confirmed as a transition object, this system would open the door to new investigations of an almost entirely unexplored galactic evolutionary pathway in forthcoming deep all-sky surveys.

### **OBSERVING DESCRIPTION**

The target should be observed for 1 full orbit in F475W and 1 full orbit in F814W. We request four exposures to be obtained in each band in order to appropriately dither over the chip gap (as the galaxy nearly fills the ACS footprint, and the center needs to be well sampled), along with adequate cosmic ray and hot pixel removal.

We request a standard dither pattern maintaining proper sampling and enabling redundancy in the chip gap. The galaxy will be centered near the middle of the two chips. There are no roll angle constraints.

Proposal 17508 - Visit 01 - HST imaging of a newly discovered many-ringed galaxy

Wed Sep 13 15:00:36 GMT 2023

Visit	<b>Proposal 17508, Visit 01</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: (none)									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
	(1)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=30 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=90 Angle Between Sides= Center Pattern=false	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=5 Line Spacing=	(1), (2)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	LEDA1313424	RA: 00 09 39.3466 (2.4139442d) Dec: +07 04 49.26 (7.08035d) Equinox: J2000	Epoch of Position: 2000 Redshift: 0.03941	V=15.3+/-1 DECAM_g 625.54 nanomaggy, DECAM_r 1550.5 nanomaggy, DECAM_z 3135.7 nanomaggy	Reference Frame: SIMBAD				
	<i>Comments:</i> Category=GALAXY Description=[DISK, INTERACTING GALAXY, RING, STAR FORMING REGION]									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1890424)	(1) LEDA1313424	ACS/WFC, ACCUM, WFC	F475W		POS TARG -5,-27	Pattern 1, Exps 1-1 in Visit 01 (1)	600 Secs (2025 Secs) [==>506.0 Secs (Pattern 1,1)] [==>506.0 Secs (Pattern 1,2)] [==>506.0 Secs (Pattern 2,1)] [==>507.0 Secs (Pattern 2,2)]	[1]
2	(1890422)	(1) LEDA1313424	ACS/WFC, ACCUM, WFC	F814W		POS TARG -5,-27	Pattern 1, Exps 2-2 in Visit 01 (1)	600 Secs (2061 Secs) [==>506.0 Secs (Pattern 1,1)] [==>506.0 Secs (Pattern 1,2)] [==>506.0 Secs (Pattern 2,1)] [==>543.0 Secs (Pattern 2,2)]	[2]	

