



11609 - NGC 6266: The Smoking Gun of Intermediate-Mass Black Holes in Galactic Globular Clusters?

Cycle: 17, Proposal Category: GO
(Availability Mode: SUPPORTED)

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	(1) NGC-6266	WFC3/UVIS	2	03-Jul-2008 21:50:09.0	yes

2 Total Orbits Used

ABSTRACT

The existence of intermediate-mass black holes (IMBHs) in star clusters has been predicted by a variety of theoretical arguments and, more recently, by several large, realistic sets of collisional N-body simulations. Establishing their presence or absence at the centers of globular clusters would profoundly impact our understanding of problems ranging from the formation and long-term dynamical evolution of stellar systems, to the nature of the seeds and the growth mechanisms of the supermassive black holes (BHs) that inhabit the centers of most large, luminous galaxies. Observationally, the unambiguous signature of a massive central BH would be the discovery of central, unresolved X-ray or radio emission that is not

consistent with more common stellar-mass accreting objects or pulsars. Yet, due to the largely uncertain details of accretion modeling, a precise mass determination of a central BH must necessarily come from stellar dynamics. This goal has not been achieved to date at the centers of Galactic globular clusters because of lack of adequate data as well as the use of too simplified methods of analysis. This situation can be overcome today through the combination of HST proper-motion measurements and state-of-the-art dynamical models specifically designed to take full advantage of this type of dataset. In this project, we will use two HST orbits to obtain another epoch of observations of NGC 6266. This cluster has photometric and structural properties that are consistent with current theoretical expectations for a cluster harboring an IMBH. Even more importantly, it is the only Galactic globular cluster for which there exists a detection of radio emission coincident with the cluster's core, and with a flux density that appears to rule out a stellar or binary origin. The goal of our project is to obtain proper motion measurements to either confirm an IMBH in this cluster and measure its mass, or to set limits to its mass and existence.

OBSERVING DESCRIPTION

The success of this project hinges on accurate astrometric measurements for a large number of stars in the center of a globular cluster. The first epoch observations that we will use were taken with ACS/WFC in F435W as part of GO-10120. We will use WFC3 to obtain another epoch of data, producing a time baseline of 5 years. The advantages of this choice of instrument include a larger field of view than that of ACS/HRC (important to adequately constrain the floor level of the mass-to-light ratio at intermediate distances during the dynamical modeling), a smaller pixel size than the ACS/WFC (thus producing even better astrometry and allowing any necessary deblending of the 1st epoch images), and avoiding the CTE effects that the ACS CCDs suffer from after seven years on orbit.

In order to suppress bright giants, we will take measurements in the F390W filter using the WFC3, which provides the best compromise between crowding issues and reasonable exposure times. Using the WFC3 ETC, we find that individual exposure times of around 420 sec do not produce any significant amount of saturation, and we plan to obtain about ten (10) such exposures to achieve the necessary signal-to-noise ratio. Shorter exposures are not an efficient approach, since this would force the instrument to dump the buffers before another exposure can start. Four (4) short, 35 sec

exposures will be taken in order to perform astrometry around stars saturated on the longer exposures.

We align our central fields with the edges of the ACS/WFC field of the first epoch in order to maximize the number of stars in common between the two epochs. Therefore, the target RA and DEC that we use for pointing do not correspond exactly with the catalogued center of the cluster. This choice of orientation constrains the window of schedulability to two weeks in the month of June, 2009.

For dithering, we use a custom-made pattern of large offsets from our central pointing, designed to randomize any systematic errors related to the location of the stars on the detector as well as make independent estimates of the internal position uncertainties.

Proposal 11609 - Visit 01 - NGC 6266: The Smoking Gun of Intermediate-Mass Black Holes in Galactic Globular Clusters?

Fri Jul 04 01:50:15 GMT 2008

Visit		Proposal 11609, Visit 01								
Visit		Diagnostic Status: No Diagnostics								
Visit		Scientific Instruments: WFC3/UVIS								
Visit		Special Requirements: SCHED 70%; ORIENT 44.5D TO 44.5 D								
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	NGC-6266 Alt Name1: M62	RA: 17 01 12.5211 (255.3021713d) Dec: -30 06 43.53 (-30.11209d) Equinox: J2000		V=7.39	Reference Frame: ICRS				
<i>Comments: 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/[Actual Dur.]	Orbit
	1		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG 15.8931 016,5.03399195		35 Secs [==>]	[1]
	2		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO			350 Secs [==>393.0 Secs]	[1]
	3		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG 15.8931 016,1.040858		350 Secs [==>393.0 Secs]	[1]
	4		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG 0.0,3.99 313394		350 Secs [==>393.0 Secs]	[1]
	5		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG -15.893 1016,-1.040858		350 Secs [==>393.0 Secs]	[1]
	6		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG 0.0,-3.9 9313394		350 Secs [==>393.0 Secs]	[1]
	7		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG -15.893 1016,-5.03399195		35 Secs [==>]	[1]
	8		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG -15.893 1016,2.95227594		35 Secs [==>]	[2]
	9		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG 0.01985 00007,0.0211999997		350 Secs [==>421.0 Secs]	[2]
	10		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG 15.8931 016,5.03399195		350 Secs [==>421.0 Secs]	[2]
	11		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG -15.893 1016,2.95227594		350 Secs [==>421.0 Secs]	[2]
	12		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG -15.893 1016,-5.03399195		350 Secs [==>421.0 Secs]	[2]
	13		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG 15.8931 016,-2.95227594		350 Secs [==>421.0 Secs]	[2]
14		(1) NGC-6266	WFC3/UVIS, ACCUM, UVIS2	F390W	CR-SPLIT=NO	POS TARG 15.8931 016,-2.95227594		35 Secs [==>]	[2]	



