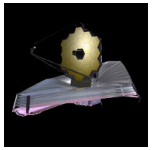

2204 - Confirming the most massive neutron star with observations of its companion

Cycle: 1, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NIRCam				
	1	NIRCam imaging	NIRCam Imaging	(1) PSRJ1748-2021B

ABSTRACT

The main objective of this proposal is to observe the center of the globular cluster NGC6440, with the aim of detecting the companion to the PSR J1748-2021B binary pulsar. This pulsar is suspected of having a mass of about 2.5 solar masses, but this value can only be confirmed if we can estimate the mass of the companion star. Detecting a low-mass companion would confirm the large pulsar mass, establishing that neutron stars can be stable at these high masses. This would have fundamental consequences for the study of the equation of state of cold, dense neutron matter and for nuclear physics. This would also have broad impact on astrophysics, indicating, for instance, that a significant fraction of NS-NS mergers leave

behind stable neutron stars, which might be detectable in future EM observations. It would also shed light on the nature of the highly asymmetric GW190814 LIGO/Virgo merger event, where a 23 solar-mass black hole merged with a lighter 2.6 solar-mass object that is currently in the mass gap between the lightest black holes and the most massive neutron stars.
The proposed observations will very likely detect the counterpart assuming it is a low-mass main sequence star or white dwarf; this would allow an estimate of the mass of the companion and the mass of the pulsar. A non-detection would indicate that the companion is a compact object, in which case we would be unable to constrain the component masses.

OBSERVING DESCRIPTION

The globular cluster NGC6440, and in particular one of its binary pulsars, PSR J1748-2021B, is targeted for NIRCam imaging observations. Only Module B is used to cover the central region of NGC6640. This is imaged in two pairs of short-plus-long-wavelength broad-band filters: F115W paired with F444W, and F200W paired with F277W. Total integration time is 7516 and 4295 seconds respectively, to reach the requested sensitivity for a 0.12-solar-mass M dwarf at S/N = 13-27 in the four bands.

The dither strategy includes a primary 4-dither INTRAMODULEBOX and a subpixel 5-point Small-Grid-Dither to produce a maximal depth for nearly the whole field and to sample the point spread functions well. The readout design uses BRIGHT2 with an optimal combination of numbers of group and integration to make the observations efficient to reach the requested sensitivity and at the same time able to measure stars with F115W =17.5 without saturation.

A special requirement to offset the target's coordinate by X = 30" and Y = 25" is made to cover all four binary pulsars in the same detector and to maximize the overlap area with HST data. There is no need for dedicated background observations as the total integration time is achieved by stacking multiple dithers and integrations, not by single long exposure. There is no requirement for the observations to be done in a particular time frame.

Proposal 2204 - Targets - Confirming the most massive neutron star with observations of its companion

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	PSRJ1748-2021B	RA: 17 48 52.9522 (267.2206342d) Dec: -20 21 38.90 (-20.36081d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[M dwarfs, Pulsars, White dwarfs]

Observation

Proposal 2204, Observation 1: NIRCam imaging Wed Mar 31 02:13:13 GMT 2021

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)	PSRJ1748-2021B	RA: 17 48 52.9522 (267.2206342d) Dec: -20 21 38.90 (-20.36081d) Equinox: J2000	Epoch of Position: 2000	

Comments:
Category=Star
Description=[M dwarfs, Pulsars, White dwarfs]

Template

Module	Subarray
B	FULL

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	INTRAMODULEBOX	4	SMALL-GRID-DITHER		5

Spectral Elements

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F115W	F444W	BRIGHT2	4	4	80	20	7515.739	59363
2	F200W	F277W	BRIGHT2	3	3	60	20	4294.708	59363

Special Requirements

Offset 30.0 arcsec, 25.0 arcsec