



12494 - Thermal emission from the famous double pulsar J0737-3039

Cycle: 19, 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) PSR-J0737-3039	ACS/SBC	3	20-Jun-2011 21:23:34.0	yes

3 Total Orbits Used

ABSTRACT

The unique double neutron star (NS) binary J0737-3039 contains two pulsars of which J0737A is expected to dominate the optical to X-ray spectrum. The two accurate clocks in the system have enabled sensitive tests of General Relativity and precise measurement of the orbital parameters and component masses. X-ray observations, mainly sensitive to a hot (polar cap) emission component, do not constrain the whole NS surface temperature well. There has been no optical/UV detection yet although our analysis shows that magnetospheric component in the optical is already ruled out by the optical limits. This opens up an opportunity to detect thermal emission in the FUV with HST. Even a non-detection, corresponding to a factor of six in temperature below the current limit, would require re-interpretation of the X-ray spectrum and will exclude possible internal re-heating mechanisms. Together with the precise mass determination, the measurement (or the limit on) the NS surface temperature will place stringent constraints on the equation of state for the superdense matter in the NS interior, providing a big scientific return from our short program.

OBSERVING DESCRIPTION

We will be performing ACS/SBC FUV imaging of the famous double pulsar J0737. Our plan is for a single filter, to achieve the deepest photometry possible.

The pulsar has never been observed at the FUV wavelengths and hence its spectrum is unknown. There are compelling reasons to believe that the spectrum is thermal but this is yet to be established. The source is likely to be faint, a reasonable upper limit on the SBC count rate is 0.2/s for the brightest thermal spectrum allowed by the X-ray spectrum and current optical upper limits. Any non-thermal or power-law spectrum would lie below this.

We will be performing ACS/SBC UV imaging for three successive orbits. To achieve the deepest sensitivity limit possible within the allocated time, we have selected F125LP and the SHADOW constraint. This ensures the best S/N for a Raleigh-Jeans spectrum emitted by the hot NS surface. The remaining non-SHADOW time in each of the orbits is given to the F140LP filter, which is less affected by the higher background than F125LP. The non-SHADOW data is not likely to contribute much to our main goal but may have some serendipitous value.

ADDITIONAL COMMENTS

BOT checks

The brightest source lies at 4" from our target. Although it was not flagged by the BOT tool, we still investigated its spectrum to ensure that it does not pose any danger to SBC. It has identifiers and magnitudes as follows:

GSC 2.3 S611010425 B=14 Jpg=13.88 N=13.47 Fpg=13.21

USNO B-1 0593-0127975 B=14.48,14.41 R=13.30,13.61 I=13.02

2MASS 07375148-3039395 J=12.819 H=12.565 K=12.501

For a V=13.2 star, a type of A3V, B-V=0 or earlier would pose a problem but these spectral types are ruled out because the source is much redder (see e.g. USNO magnitudes above).

BOT has given warnings for 3 stars under the assumptions that they are O5V type. However these stars have V>16 and B-V>0.7 (according to GSC

2.3), and so they are safe. The only other source that was flagged as "unknown" by BOT has faint magnitudes (Fpg~16, Jpg~17.2, which are red and blue, respectively), reddish spectrum, and hence is also safe.

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Visit	Proposal 12494, Visit 01										Tue Jun 21 01:23:38 GMT 2011						
	Diagnostic Status: No Diagnostics																
	Scientific Instruments: ACS/SBC																
	Special Requirements: (none)																
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous							
	(1)	PSR-J0737-3039		RA: 07 37 51.2470 (114.4635292d) Dec: -30 39 40.74 (-30.66132d) Equinox: J2000				V=30		Reference Frame: ICRS							
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.																
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture		Spectral Els.		Opt. Params.		Special Reqs.		Groups		Exp. Time/[Actual Dur.]		Orbit	
	1	(ACS.im.17 8878)	(1) PSR-J0737-3039	ACS/SBC, ACCUM, SBC		F125LP				SHADOW				1839 Secs			
													[==>1839.0 Secs]		[1]		
	2	(179222)	(1) PSR-J0737-3039	ACS/SBC, ACCUM, SBC		F140LP								615 Secs			
													[==>]		[1]		
	Comments: This exposure is taken once the observatory has left the shadow, to use up the visibility. It is of secondary importance.																
	3	(ACS.im.17 8878)	(1) PSR-J0737-3039	ACS/SBC, ACCUM, SBC		F125LP				SHADOW				1857 Secs			
													[==>]		[2]		
	4	(179222)	(1) PSR-J0737-3039	ACS/SBC, ACCUM, SBC		F140LP								615 Secs			
													[==>]		[2]		
	Comments: This exposure is taken once the observatory has left the shadow, to use up the visibility. It is of secondary importance.																
	5	(ACS.im.17 8878)	(1) PSR-J0737-3039	ACS/SBC, ACCUM, SBC		F125LP				SHADOW				1857 Secs			
													[==>]		[3]		
	6	(179222)	(1) PSR-J0737-3039	ACS/SBC, ACCUM, SBC		F140LP								615 Secs			
													[==>]		[3]		
	Comments: This exposure is taken once the observatory has left the shadow, to use up the visibility. It is of secondary importance.																

