



11154 - Optical-UV Spectrum of the Middle-aged Pulsar B1055-52

Cycle: 16, 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) PSR1055-52	WFPC2	4	17-Jan-2008 22:36:21.0	yes
02	(1) PSR1055-52	ACS/SBC	2	17-Jan-2008 22:36:27.0	yes

6 Total Orbits Used

ABSTRACT

The middle-aged radio, X-ray and gamma-ray pulsar B1055-52 is one of the few pulsars that allow a multiwavelength study of pulsar radiation. An optical counterpart of the pulsar has been detected with the HST FOC, but it was observed in only one filter (F342W, m=24.9). To understand the nature of the pulsar radiation, its spectrum must be measured in a broad wavelength range. We propose imaging observations of the pulsar's counterpart with WFPC2 in the red part of the spectrum and ACS/SBC in the UV part to measure the broadband spectral distribution, compare it with the X-ray spectrum, and investigate the thermal and magnetospheric components of the pulsar's radiation.

OBSERVING DESCRIPTION

To study the optical part of the pulsar's spectrum (redward of the previously observed F342W band), we will use the PC camera of the WFPC2 instrument. To obtain a broad and even spectral coverage, 4900-7700 Å, we will image the target in three WFPC2 filters: F450W, F555W, and F702W. For the F450W and F555W observations, we estimated that one HST orbit per filter will provide $S/N > 6$, depending on the actual source flux, sky background and position of the target center with respect to the pixel center. To reach a similar S/N with the F702W filter two HST orbits are required. Thus, we group the WFPC2 observations with the three filters into Visit 1 consisting of 4 orbits. For cosmic ray rejection and warm pixel rejection, we use the 3-point dither pattern WFC2-LINE with point spacing 0.3535 arcsec in each of the 4 orbits. To avoid bloom tracks and diffraction spikes from the nearby (3.6 arcsec), relatively bright ($V=14.6$) star A (see below), we request $ORIENT = 10-40$ or $190-220$ degrees. According to the Visit Planner in the APT, the visit is schedulable for 13 days in March-April 2008.

We supplement the optical WFPC2 observations with an FUV imaging exposure using the SBC long-pass filter F140LP (1370-1670 Å). To assure firm detection of the FUV flux with the SBC F140LP filter ($S/N > 5$ for the lowest possible flux of 0.047 microJy at 1400 Å), we need two HST orbits, which will constitute Visit 2. In each of the two exposures corresponding to these two orbits we request $POS\ TARG\ Y-Offset=-4.5$ arcsec to reduce the dark current background (which is known to have a nonuniform distribution on the SBC detector). Our previous observations with SBC (program GO-10568) have shown that this close-to-optimum offset can reduce the dark current count rate by a factor of 4-6.

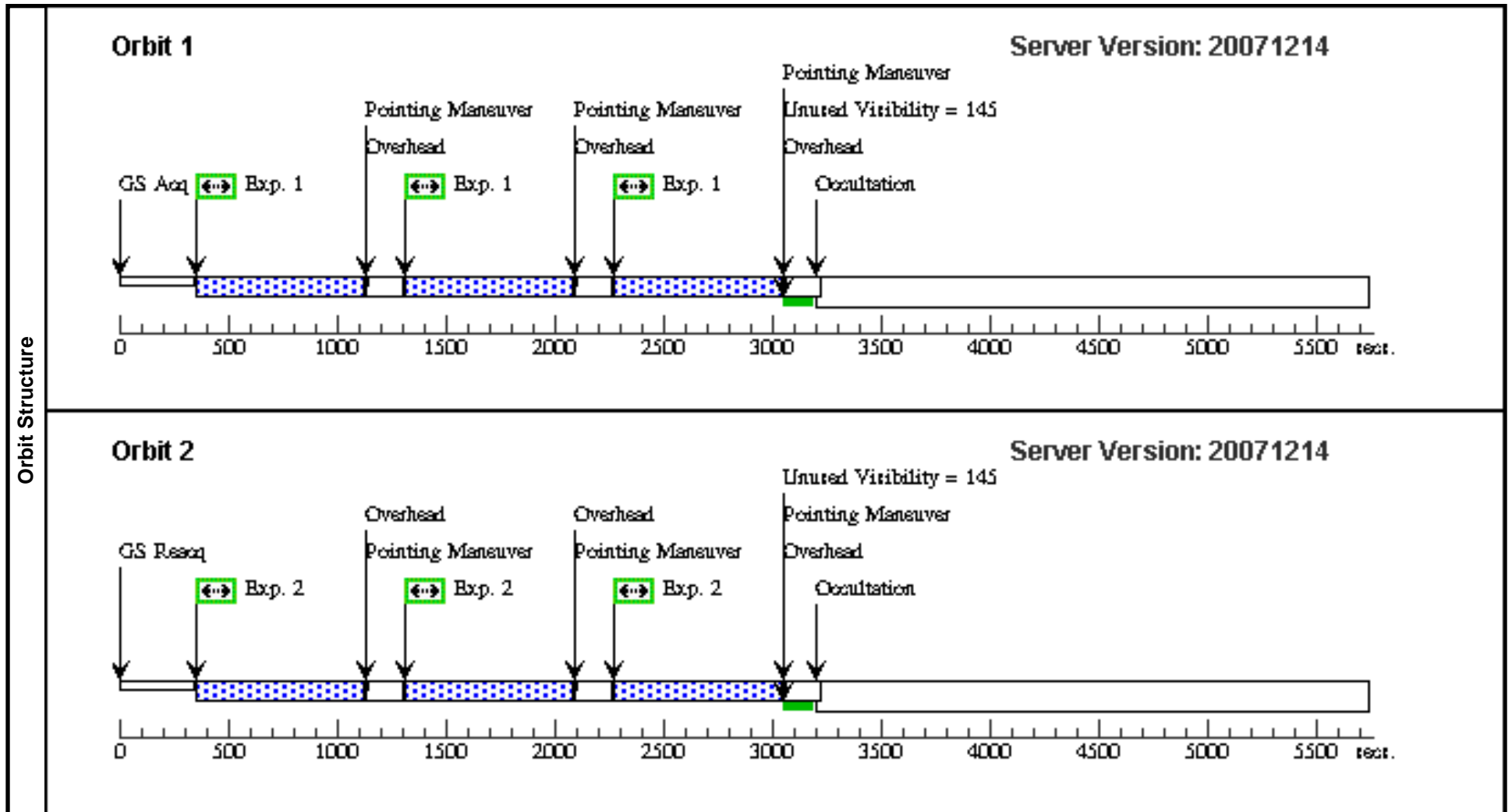
We have also examined the stars within 40 arcsec from the target to make sure that the SBC brightness limit will not be violated. Although the APT Bright Object Tool (BOT) flags three brightest stars as potentially dangerous (they are designated as A, B and J in the previous works on observations of the PSR B1055-52 field -- e.g., Manchester et al. 1978, MNRAS, 184, 159), after examining the multiband photometry from several major catalogs (e.g., GSC 2.2, USNO-A2, USNO-B, 2MASS, DENIS) we conclude that these stars do not represent any danger for SBC. Indeed, the brightest star A has magnitudes $B_{mag}=15.2$, $V_{mag}=13.8$, $R_{mag}=13.3$ (GSC 2.2) and $I_{mag}=13.2$ (DENIS), and it was found to be a normal F star based on its spectrum (Cheng and Helfand, ApJ, 1983, 271, 271; we note that $V=14.6$ is quoted in this work and in Manchester et al. 1978, i.e. the star A's V magnitude is fainter than the photographic V_{mag} quoted in GSC 2.2). The other two stars have magnitudes $B_{mag}=15.8$, $V_{mag}=14.0$, $R_{mag}=13.4$, $I_{mag}=12.7$, and $B_{mag}=16.0$, $V_{mag}=15.2$, $R_{mag}=14.8$, $I_{mag}=14.4$, and therefore are even redder than star A (likely, stars B and J are

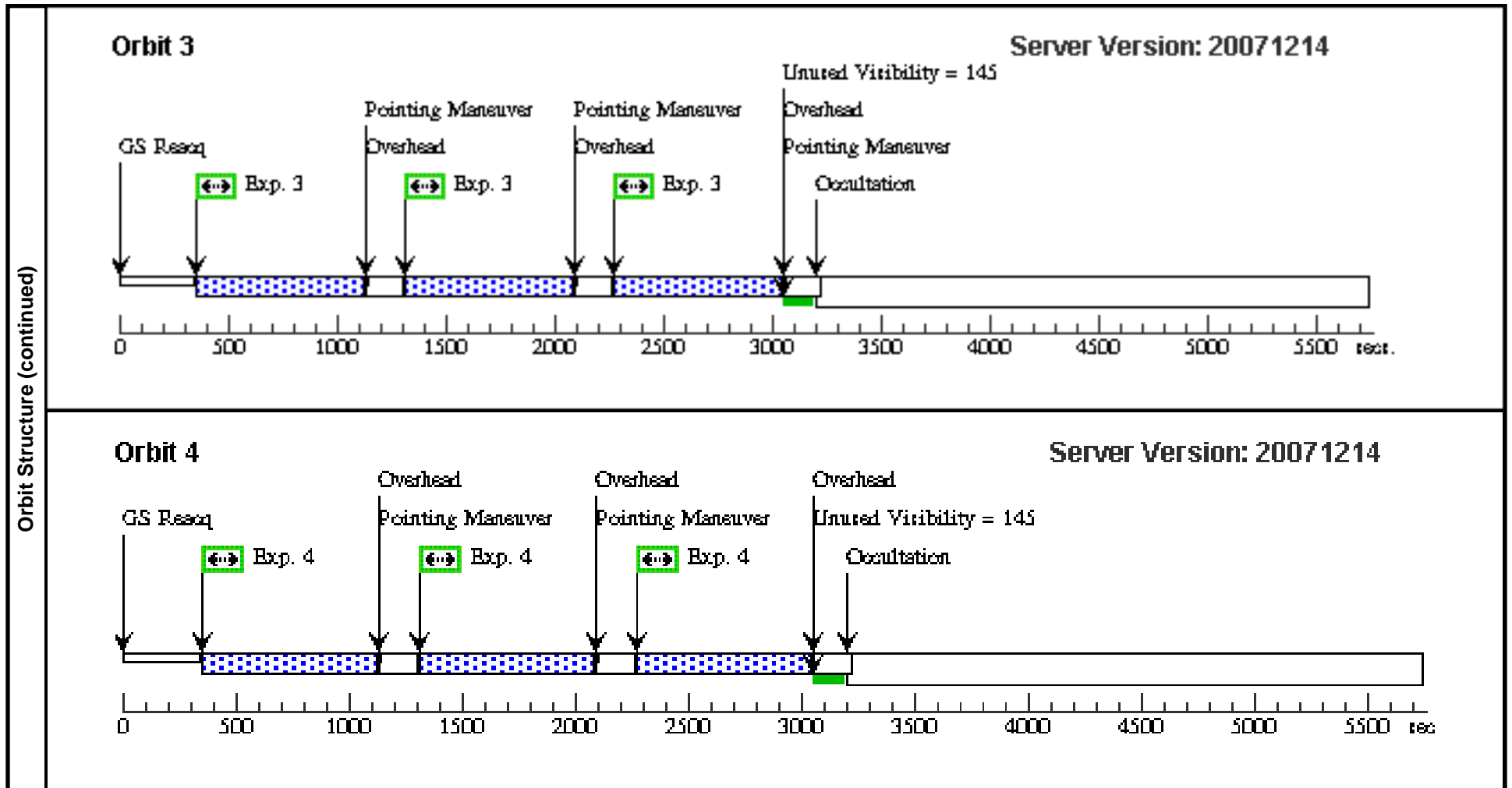
of K and G spectral classes, respectively). Therefore, none of these three stars is of a spectral class earlier than A1V, which would be dangerous at such magnitudes, according to Table 7.4 from the ACS Instrument Handbook. In addition to the three stars, the BOT flags four sources as "unknown" (possibly not stars or there is no sufficient information). Only one of these sources might be of some concern, which we designate as source X (the others have $B_{\text{mag}} > 19.8$). This source appears to be slightly extended in the DSS images (it is classified as "not a star" in the GSC2.2) and has $B_{\text{mag}}=17.5$, $V_{\text{mag}}=16.1$, $R_{\text{mag}}=15.7$ and $I_{\text{mag}}=14.8$. With such red colors, the source should not be of any danger to SBC. Moreover, if it is a galaxy, it should be very faint in the FUV range, due to both the intrinsic redness and the ISM extinction ($A_V \sim 2$ in this direction). Therefore, we consider source X to be safe for SBC observations.

Proposal 11154 - Visit 01 - Optical-UV Spectrum of the Middle-aged Pulsar B1055-52

Fri Jan 18 03:36:30 GMT 2008

Visit		Proposal 11154, Visit 01 Diagnostic Status: No Diagnostics Scientific Instruments: WFPC2 Special Requirements: ORIENT 10.0D TO 40.0 D; ORIENT 190.0D TO 220.0 D								
Patterns	#	Primary Pattern			Secondary Pattern		Exposures			
	(1)	Pattern Type=WFPC2-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.3535 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=45.0 Angle Between Sides= Center Pattern=false				(1), (2), (3), (4)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	PSR1055-52	RA: 10 57 58.8400 (164.4951667d) Dec: -52 26 56.30 (-52.44897d) Equinox: J2000		V=25+/-1 0.16 microJy at 3420 A	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	f702w1	(1) PSR1055-52	WFPC2, IMAGE, PC1	F702W	CR-SPLIT=NO		Pattern 1-1 (1)	2500.0 Secs [=>600.0 Secs (Pattern 1)] [=>600.0 Secs (Pattern 2)] [=>600.0 Secs (Pattern 3)]	[1]
	2	f702w2	(1) PSR1055-52	WFPC2, IMAGE, PC1	F702W	CR-SPLIT=NO		Pattern 2-2 (1)	2500.0 Secs [=>600.0 Secs (Pattern 1)] [=>600.0 Secs (Pattern 2)] [=>600.0 Secs (Pattern 3)]	[2]
	3	f555w	(1) PSR1055-52	WFPC2, IMAGE, PC1	F555W	CR-SPLIT=NO		Pattern 3-3 (1)	2500.0 Secs [=>600.0 Secs (Pattern 1)] [=>600.0 Secs (Pattern 2)] [=>600.0 Secs (Pattern 3)]	[3]
	4	f450w	(1) PSR1055-52	WFPC2, IMAGE, PC1	F450W	CR-SPLIT=NO		Pattern 4-4 (1)	2500.0 Secs [=>600.0 Secs (Pattern 1)] [=>600.0 Secs (Pattern 2)] [=>600.0 Secs (Pattern 3)]	[4]





Visit	Proposal 11154, Visit 02 Diagnostic Status: No Diagnostics Scientific Instruments: ACS/SBC Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
(1)		PSR1055-52	RA: 10 57 58.8400 (164.4951667d) Dec: -52 26 56.30 (-52.44897d) Equinox: J2000		V=25+/-1 0.16 microJy at 3420 A	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	(1) PSR1055-52	(1) PSR1055-52	ACS/SBC, ACCUM, SBC	F140LP		POS TARG 0.0,-4.5		3000.0 Secs [=>2764.0 Secs]	[1]
	2	(1) PSR1055-52	(1) PSR1055-52	ACS/SBC, ACCUM, SBC	F140LP		POS TARG 0.0,-4.5		3000.0 Secs [=>2805.0 Secs]	[2]
Orbit Structure	<p>Orbit 1 Server Version: 20071214</p> <p>GS Acq Exp. 1 Occultation Unred Visibility = 0</p> <p>0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 sec.</p>									

