



Publication Year	2016
Acceptance in OA	2020-05-13T15:25:08Z
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Handle	http://hdl.handle.net/20.500.12386/24800

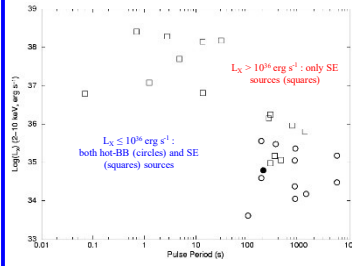


The soft X-ray spectrum of transient pulsars in the Small Magellanic Cloud

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Spectral properties of High Mass X-Ray Binaries



X-ray spectrum between 0.1 and 10 keV:
 • usually described by a rather flat power law (photon index $\Gamma \sim 1$) with an exponential cut-off
 • often with Fe K α emission lines
 BUT
 several XRBs have a marked data excess above the main power-law component (see La Palombara & Mereghetti 2006, for a review):
 • Bright, transient sources ($L_X > 10^{38}$ erg s⁻¹): 'Soft' Excess well described with a low temperature ($kT_{bb} < 0.5$ keV) and large emission area ($R_{bb} > a$ few hundreds km) thermal emission model (either a blackbody, bremsstrahlung, or hot plasma emission)
 • Low-luminosity, persistent sources ($L_X \leq 10^{38}$ erg s⁻¹): instead of a SE, in some cases a 'hot BB' excess of high temperature ($T_{bb} > 0.5$ keV) and small emission area ($R_{bb} < 2$ km) is observed.
 Only in a few cases this low-energy component shows pulsations
 the debate about its origin remains open

Source ^a	Location	Distance (kpc)	Component	P_{spin} (s)	L_X (erg s ⁻¹)	\dot{M} (M \odot yr ⁻¹)	\dot{M}_{in} (M \odot yr ⁻¹)	Low-LX	SE model ^b	Hot BB ^c	SE Pulsar ^d
Her X-1	Galaxy	~8	AV	1.32	1.3×10^{39} (0.1-10)	3.5×10^{-10}	0.05	0.01-0.10	BB, TB, PL	0.67-0.12	Yes
SMC X-1	SMC	65	BB	1.7	3.4×10^{38} (0.1-10)	4.7×10^{-10}	2.5	0.06	BB, TB, SPL	0.15-0.18	Yes
LMC X-4 ^e	LMC	50	07 BB/PL	15.5	1.2×10^{38} (0.1-10)	4.0×10^{-10}	-0.5	0.04	BB, BB, TB, COM, SPL	0.15	Yes
XTE J0112.2-7317 ^f	SMC	65	BB/PL	20.05	1.8×10^{38} (0.1-10)	3.8×10^{-10}	1.8	0.20	SPL	-	Yes
RX J0059.2-7138 ^g	SMC	65	BB/PL	2.76	2.6×10^{38} (0.1-10)	5.1×10^{-10}	0.42-0.59	0.31	MEK, SPL	-	Yes
4U 1626-67 ^h	Galaxy	~8	low mass	7.1	2.6×10^{38} (0.1-10)	2.2×10^{-10}	0.0	0.0	BB	0.04	Yes
Vela X ⁱ	Galaxy	1.9	BB/PL	203	2.2×10^{38} (2-10)	1.1×10^{-10}	4.2	-0.01	TB	0.21	Yes
EXO 053109-6609-2 ^j	LMC	49.85	BB/PL	4.87	1.8×10^{38} (0.1-10)	1.7×10^{-10}	1.5	0.24	MEK, PL	-	Yes
AX J0052.7-7133 ^k	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^l	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^m	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ⁿ	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^o	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^p	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^q	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^r	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^s	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^t	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^u	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^v	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^w	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^x	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^y	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^z	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{aa}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ab}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ac}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ad}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ae}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{af}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ag}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ah}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ai}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{aj}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ak}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{al}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{am}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{an}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ao}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ap}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{aq}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ar}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{as}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{at}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{au}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{av}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{aw}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ax}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ay}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{az}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{ba}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bb}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bc}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bd}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{be}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bf}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bg}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bh}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bi}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bj}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bk}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bl}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bm}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bn}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bo}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bp}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bq}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{br}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bs}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bt}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bu}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bv}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bw}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{bx}	SMC	65	BB	13.7	4.8×10^{37} (0.1-10)	1.5×10^{-10}	6.9	?	MEK, PL	-	Yes
AX J0052.7-7133 ^{by}	SMC	65									