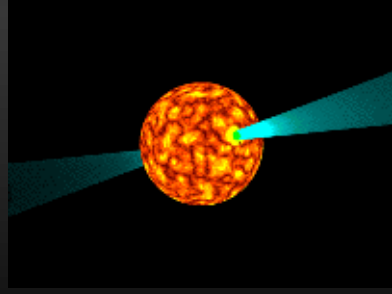

THE CURVATURE EMISSION MODEL OF PECULIAR ISOLATED NEUTRON STAR 2XMM J104608.7-594306

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XDINS - X-ray Dim Isolated Neutron Stars

The Magnificent Seven (M7)

- RX 1856.5-3754,
- RBS1223,
- RBS1774,
- RXJ1605.3+3249,
- RXJ0420.0-5022,
- RXJ0720.4-3125,
- RXJ0806.4-4123
- 2XMM J140608.7-594306
- RX J1412.9-7922 (Calvera)

ROSAT - Röntgensatellit

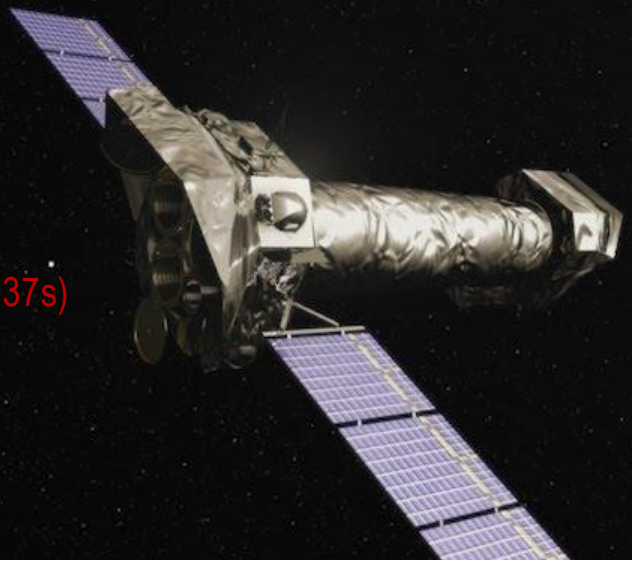
Object	P $[s]$	dP/dt $[10^{-13} ss^{-1}]$	B_{dip} $[10^{13} G]$	*Ref*
RX J0420.0-5022	3.45	0.28(3)	1.0	1
RX J0720.4-3125	8.39	0.698(2)	2.4	2
RX J0806.4-4123	11.37	0.55(30)	2.5	3
1RXS J1308.8+2127	10.31	1.120(3)	3.4	4
RX J1605.3+3249	3.39			
RX J1856.5-3754	7.06	0.297(7)	1.5	5
1RXS J2143.0+0654	9.43	0.4(2)	2.0	6

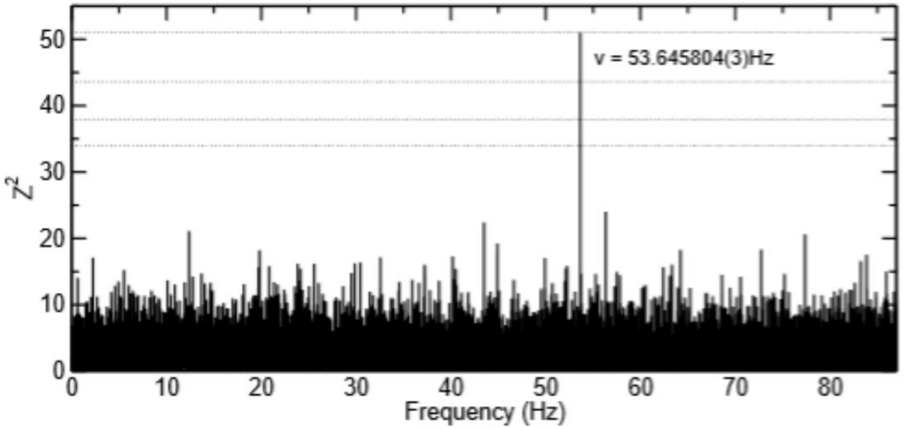
1. Kaplan & van Kerkwijk 2011, ApJ 740, L30
2. Kaplan & van Kerkwijk 2005a, ApJ 628, L45
3. Kaplan & van Kerkwijk 2009b, ApJ 705, 798
4. Kaplan & van Kerkwijk 2005b, ApJ 635, L65
5. van Kerkwijk & Kaplan 2008, ApJ 673, L163
6. Kaplan & van Kerkwijk 2009a, ApJ 692, L62

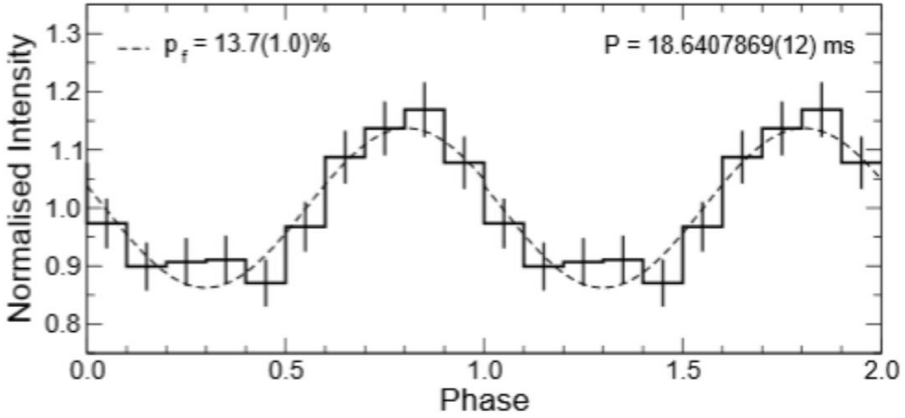
THE ISOLATED NEUTRON STAR CANDIDATE 2XMM J104608. 7-594306

- A new INS candidate;
- Detected by XMM-Newton
- Located in the Carina Nebula;
- $kT^{\infty} \sim (133.1 \pm 1.9) eV$;
- $N_H \sim 3.2 \times 10^{21} cm^{-2}$;
- P=18.6msec (M7 – P ~ 3.39-11.37s)
- $B_{dip} = (3-8) * 10^{11} G$

  (M7- B$\sim 10^{13} - 10^{14} G$)





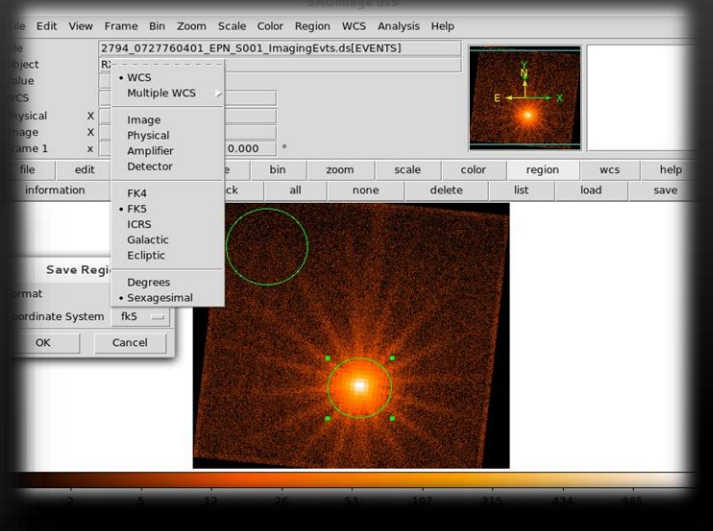


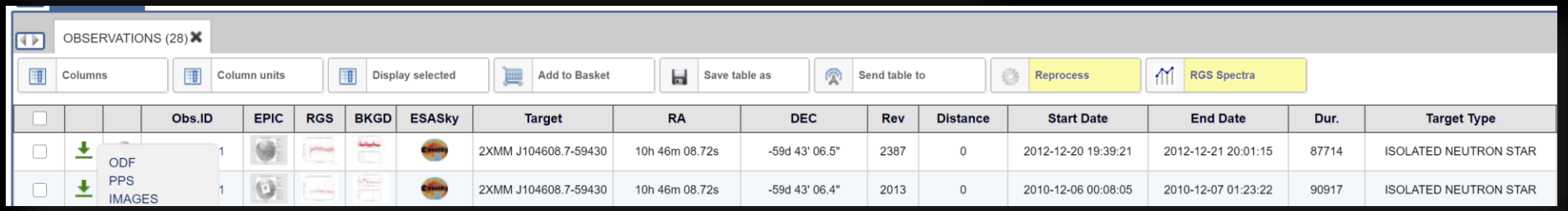
M7-like? Yes! But P≈19 msec

Pires, A.M., Motch, C., Turolla, R., et al. 2015, A&A, 583, A117 .

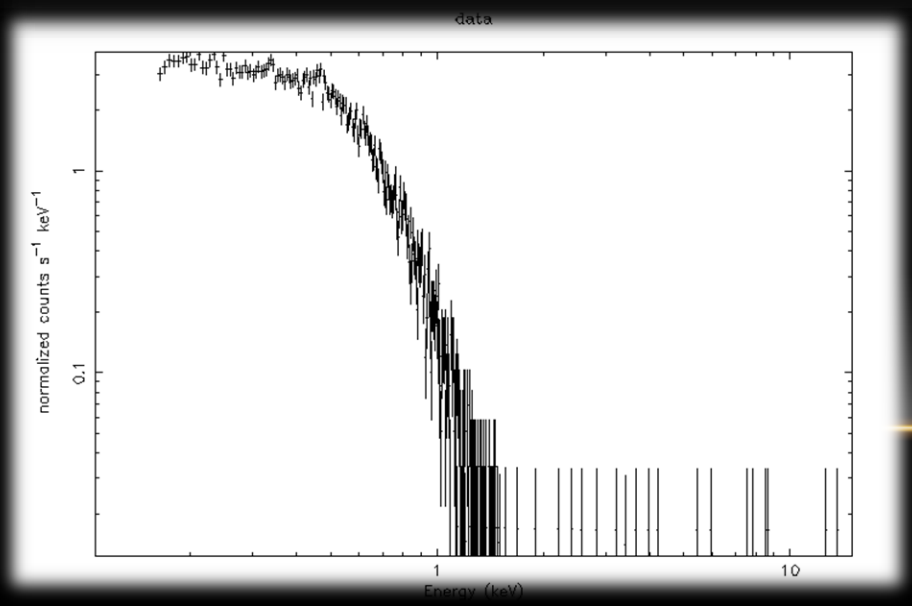
DATA ANALYSIS

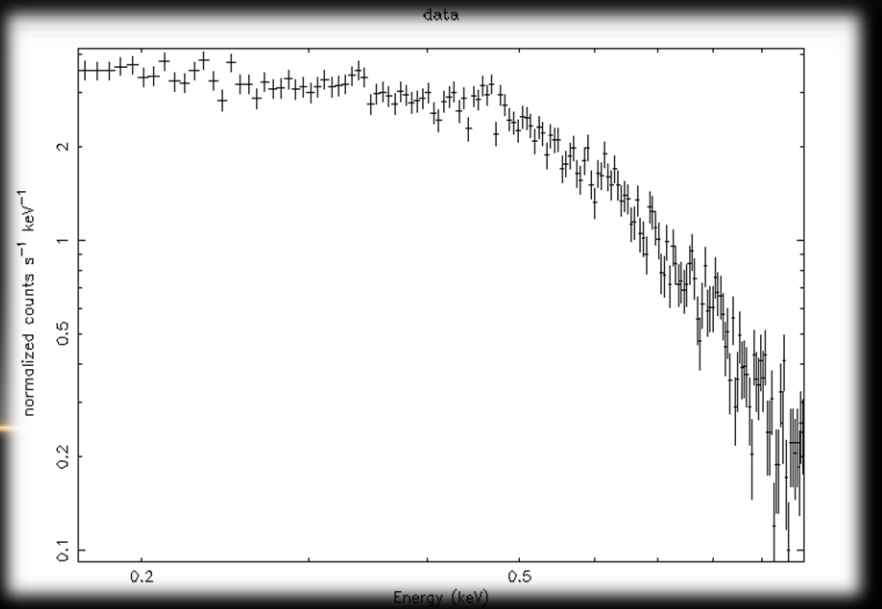
- SAS-Science Analysis Software
- XSPEC (An X-ray Spectral Fitting Package)



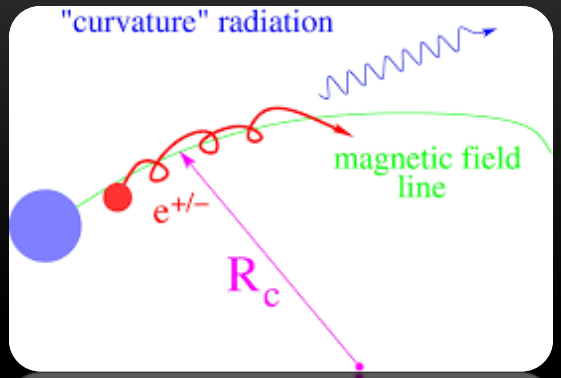


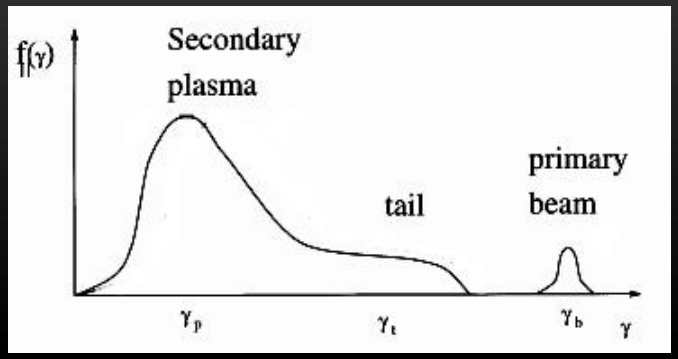
Obs.ID	EPIC	RGS	BKGD	ESASky	Target	RA	DEC	Rev	Distance	Start Date	End Date	Dur.	Target Type
					2XMM J104608.7-59430	10h 46m 08.72s	-59d 43' 06.5"	2387	0	2012-12-20 19:39:21	2012-12-21 20:01:15	87714	ISOLATED NEUTRON STAR
					2XMM J104608.7-59430	10h 46m 08.72s	-59d 43' 06.4"	2013	0	2010-12-06 00:08:05	2010-12-07 01:23:22	90917	ISOLATED NEUTRON STAR





CURVATURE RADIATION





One-dimensional distribution function of $e^- e^+$ plasma

$\gamma_p \sim 1$

$\gamma_t \sim 10^{4-5}$

$\gamma_b \sim 10^6$

$$r_B = \epsilon / \omega_B m_e c$$

ϵ - electron's energy;
ω_B - cyclotron frequency
m_e - electron's mass

(1)

$$P_\omega(\omega, \gamma) = \frac{\sqrt{3}}{2\pi} \frac{e^2}{R_B} \gamma \frac{\omega}{\omega_c} \int_{\omega/\omega_c}^{\infty} K_{5/3}(z) dz, \quad \omega_c = \frac{3}{2} \frac{c}{R_B} \gamma^3$$

$P_\omega(\omega, \gamma)$ - spectral radiation power;
$K_{\frac{5}{3}}(z)$ - McDonald function;
ω_c characteristic radiation frequency

(2)

$$F_\varepsilon \propto \exp\left[-\left(\frac{\varepsilon}{\varepsilon_0}\right)^\alpha\right],$$

α - positive number;
ε_0 shows the cutoff energy

(3)

Spectral analysis

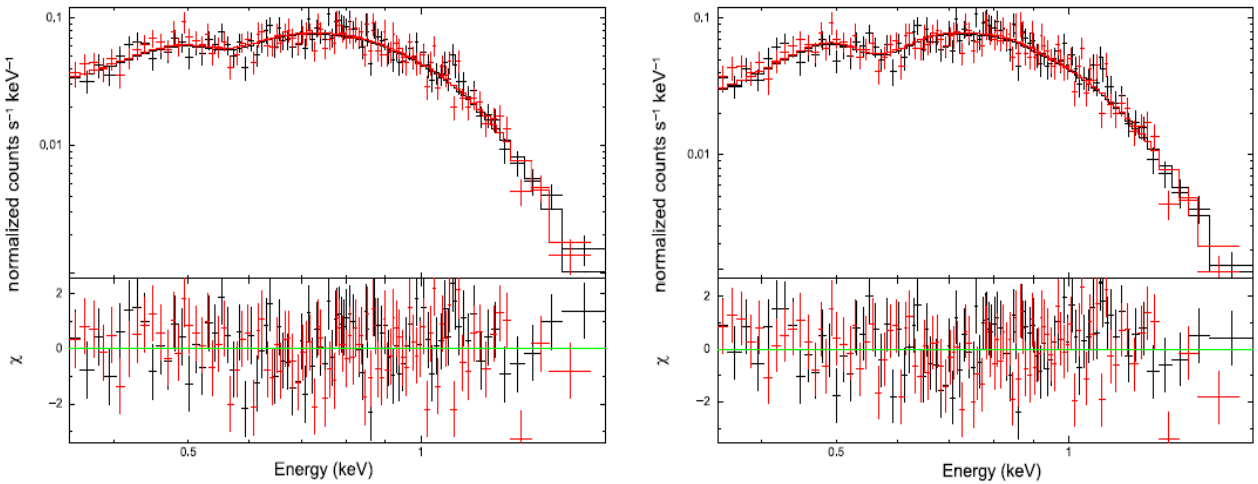


Figure 3: Results of spectral fitting of 2XMM J104608.7-594306. Two pn spectra fitted with the curvature model (left) and the blackbody model (right).

Model	N_H $(10^{21} cm^{-2})$		Parameter	χ^2(d.o.f.)
curvature	$1.39^{+0.04}_{-0.04}$	ε_0(keV)	0.64 ± 0.09	1.07(275)
-	-	α	2.07 ± 0.28	-
bbody	$2.69^{+0.02}_{-0.02}$	kT^{∞}_{bb}(eV)	120.3 ± 3.0	1.11(276)
powerlaw	$9.67^{+0.53}_{-0.53}$	Γ	9.5 ± 0.3	3.52(276)

Table 2: Results of spectral fits to XMM-Newton observations

Conclusions

- Blackbody component absorbed by cold interstellar matter gives $\chi^2 = 1.11$;
- The spectrum must undergo super exponential cutoff for higher energies;
- The fit with curvature model gave the better results, particularly reduced $\chi^2 = 1.07$, than BB model.
- The value of curvature radius of the local field lines, that proves that the assumption for emission generation region is correct.

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Thank you for your attention