

# **On the prospects of an SMC survey with XMM-Newton**

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**History of X-ray observations of the SMC**

**Archival XMM-Newton Observations – first results**

**A proposal for a complete survey**



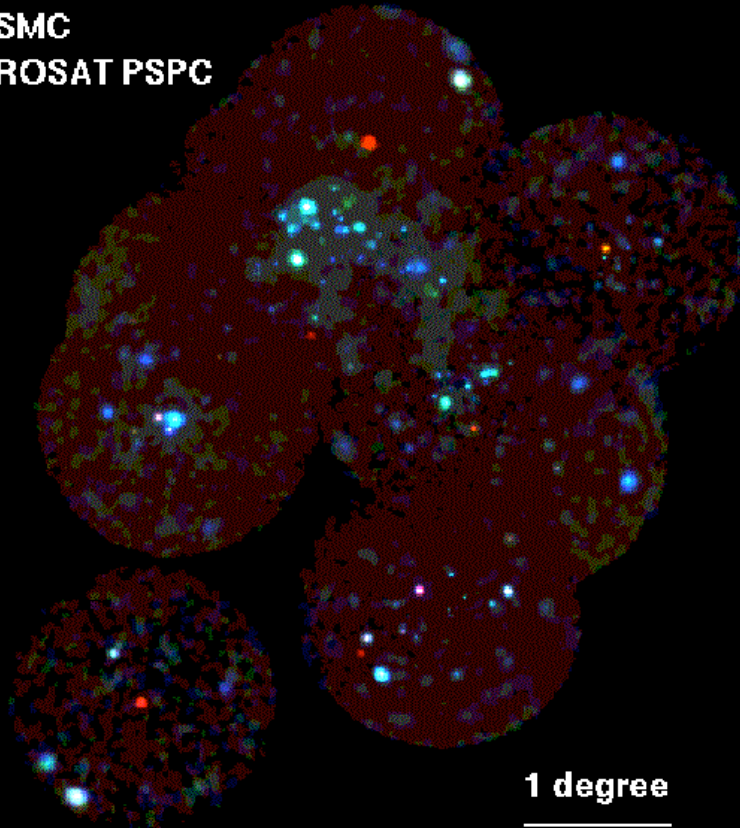
**XMM–Newton: The Next Decade**

**ESAC, Villafranca del Castillo, Madrid, Spain, June 4-6, 2007**

# Historical X-ray studies of the SMC

- Einstein IPC  
70 discrete X-ray sources (*Wang et al. 1991, Wang & Wu 1992*)
- ROSAT PSPC and HRI  
517 sources (PSPC), 121 sources (HRI, 46 additional)  
(*Haberl et al. 2000, Sasaki et al. 2000*)

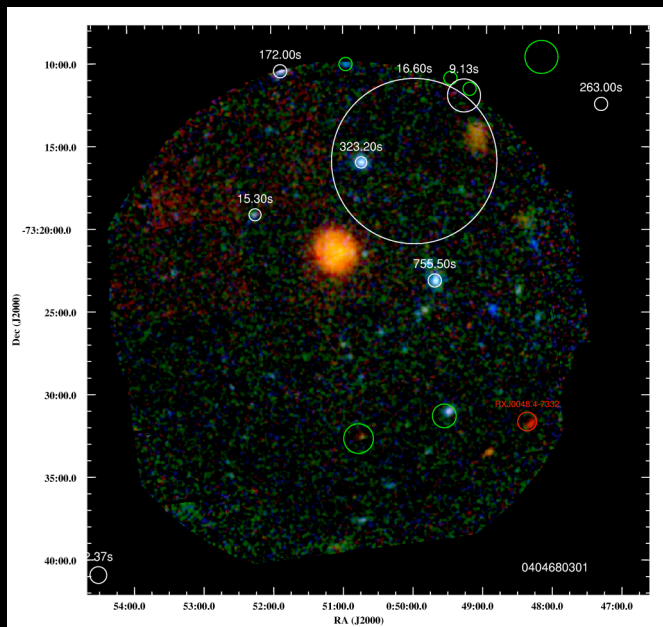
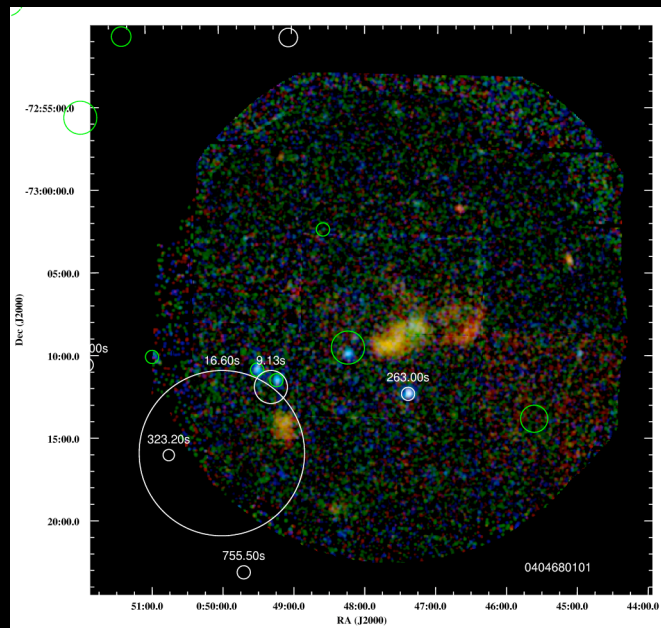
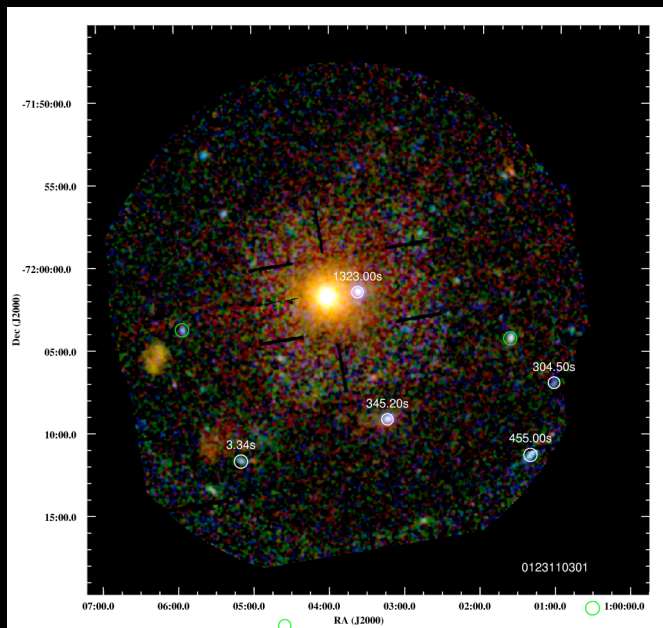
SMC  
ROSAT PSPC



Mosaic of ROSAT pointed observations  
in 6x6 degree field

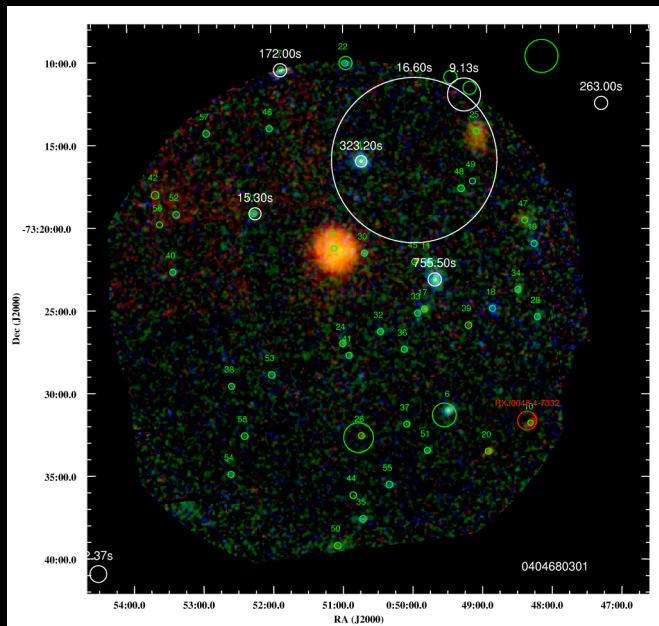
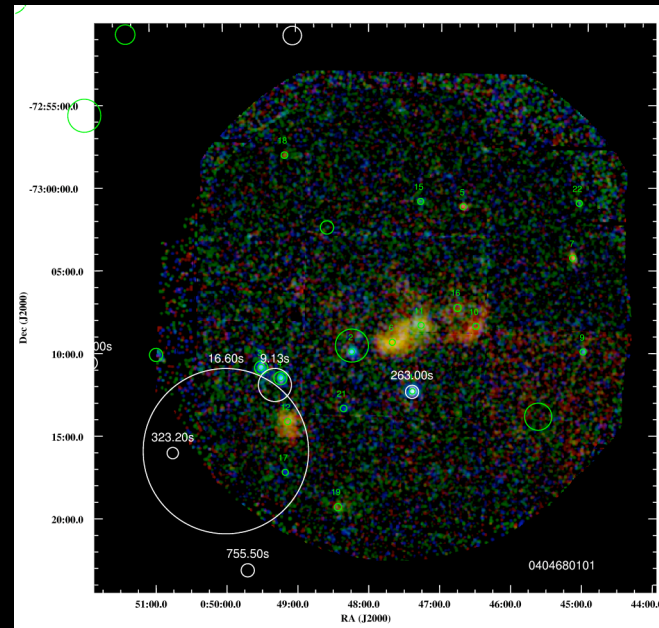
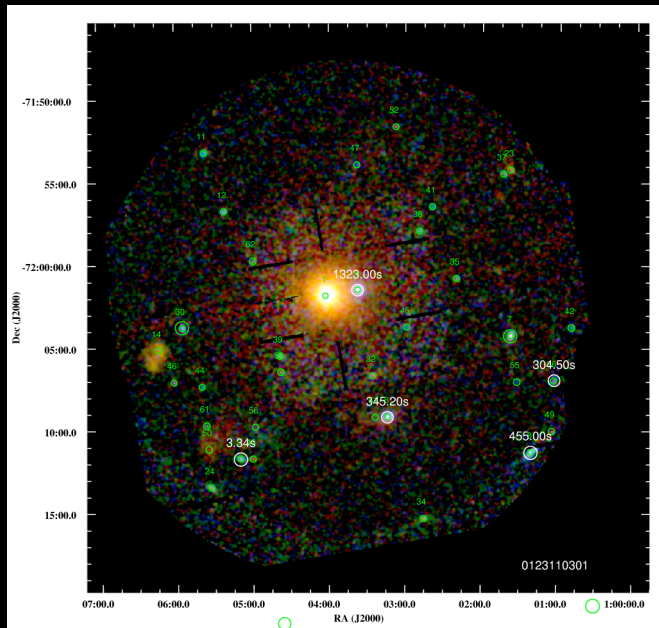
The brightest sources are  
HMXBs  
SNRs  
SSSs

# Archival XMM-Newton observations of the SMC



3 example observations  
known HMXBs and candidates marked

# Archival XMM-Newton observations of the SMC



Source detection simultaneously  
in 5 energy bands, 3 instruments

32 observations:

about half of them on 1E0102-72.3

1406 detections after manual screening

(multiple detections in extended regions, oot events)

~935 individual sources

790 sources detected once

1 source detected 16 times





## **Archival XMM-Newton observations of the SMC**

### **Mosaic**

**pn in FF/eFF/LW mode  
background screening (min 4ks)  
30 observations**

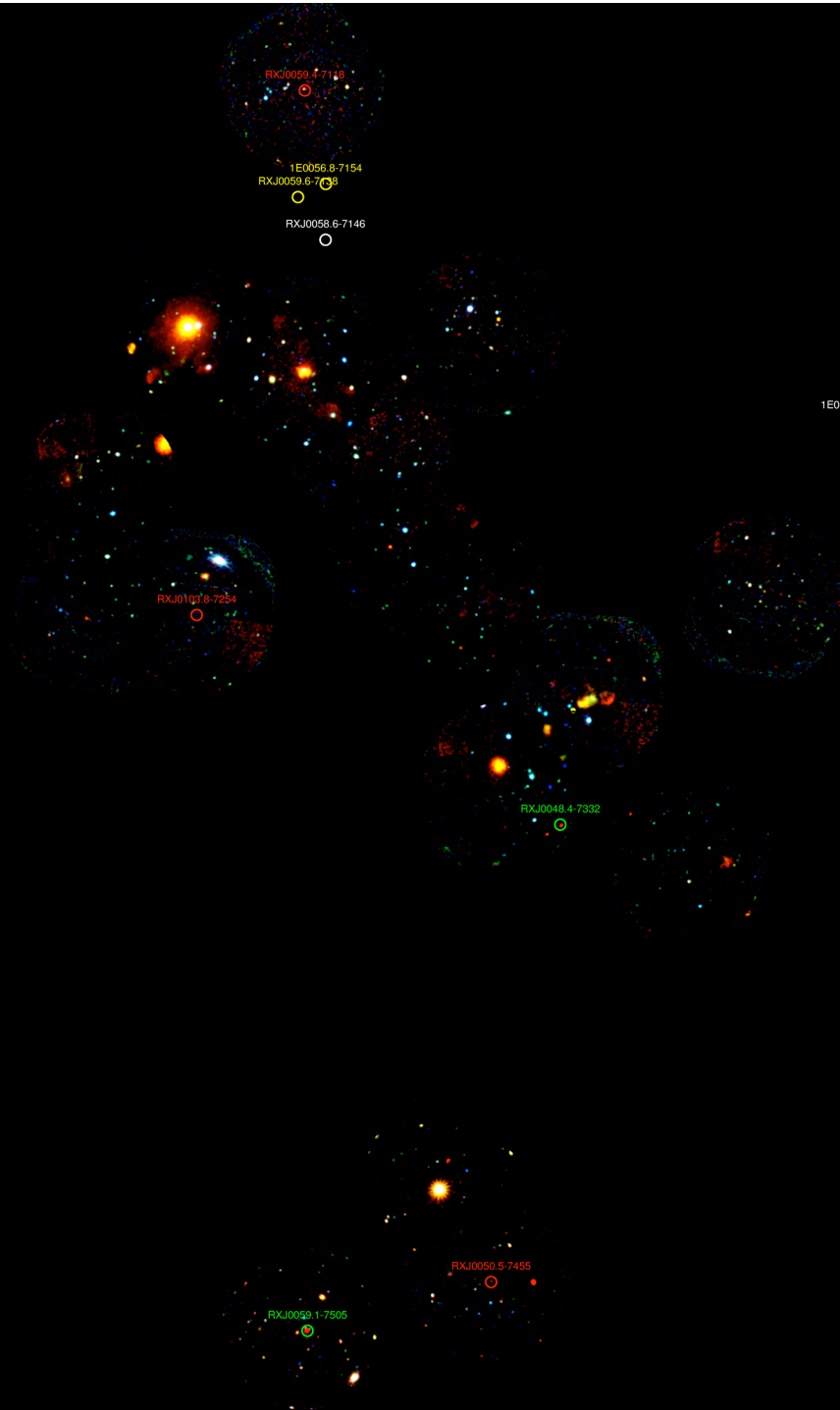
**max exposure @ 1E0102-72.3:  
210 ksec (pn)  
250 ksec (MOS)  
typical exposure: 10 – 20 ksec**

Supersoft X-ray Sources

Symbiotic System

Planetary Nebula

Faint SSS

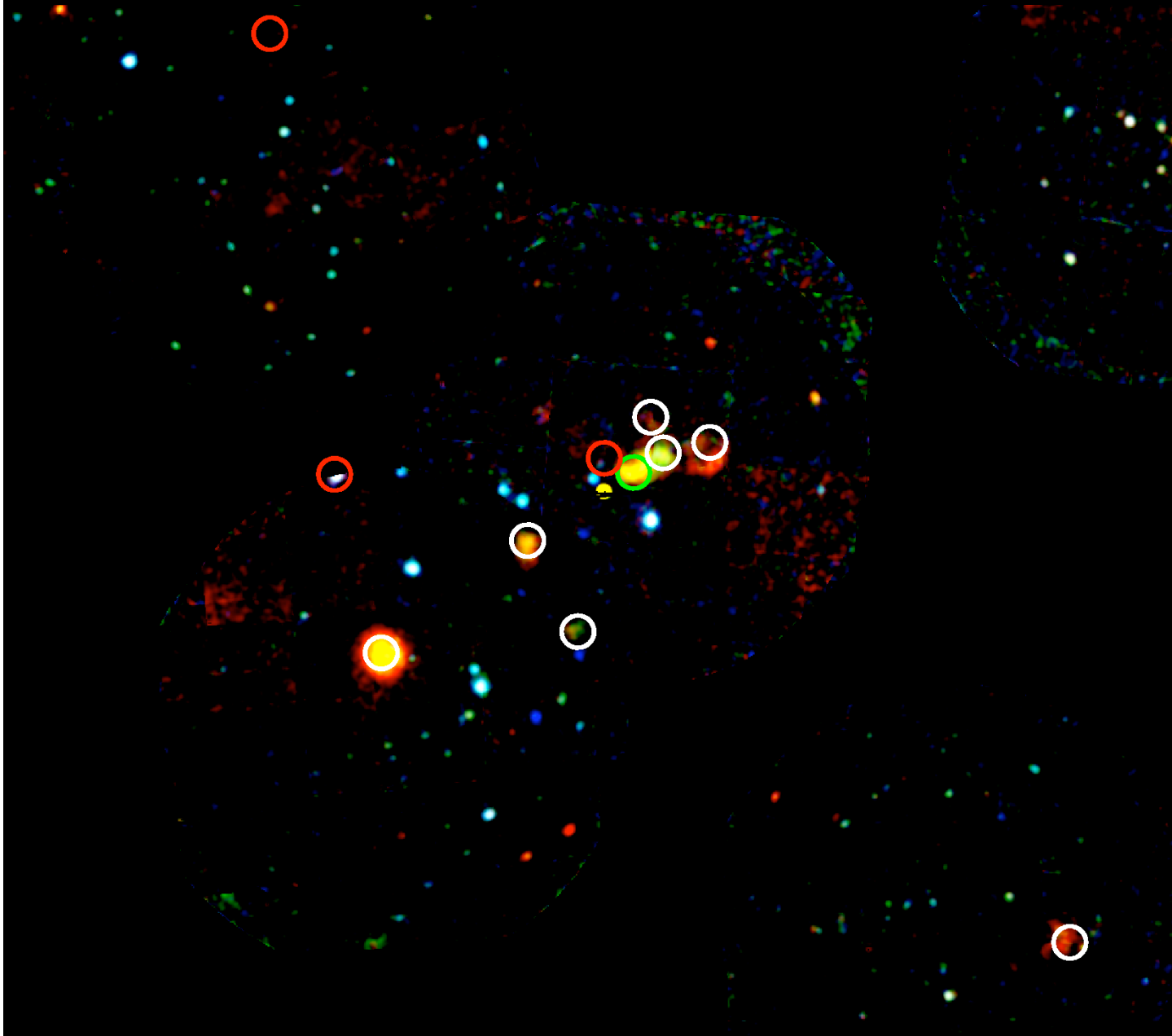


# Population studies I

## Supersoft X-ray sources

Old population involving white dwarfs  
Best observable in the Magellanic Clouds  
Located in outer (older) parts  
Most known SSS are already covered  
(accepted northern pointing)  
1E0035.4-7230 far W

## Population studies II - Supernova Remnants



**17 spectroscopically  
confirmed  
Radio SNRs  
5 Radio candidates  
(Filipovic et al. 2005)  
4 ROSAT candidates**

**Concentration on each  
end of the Main Body**

# Population studies III – High Mass X-Ray Binaries

High Mass X-ray Binary Pulsars

Candidates

An exceptionally large population in the SMC

43 pulsars

5 unknown position

20 candidates

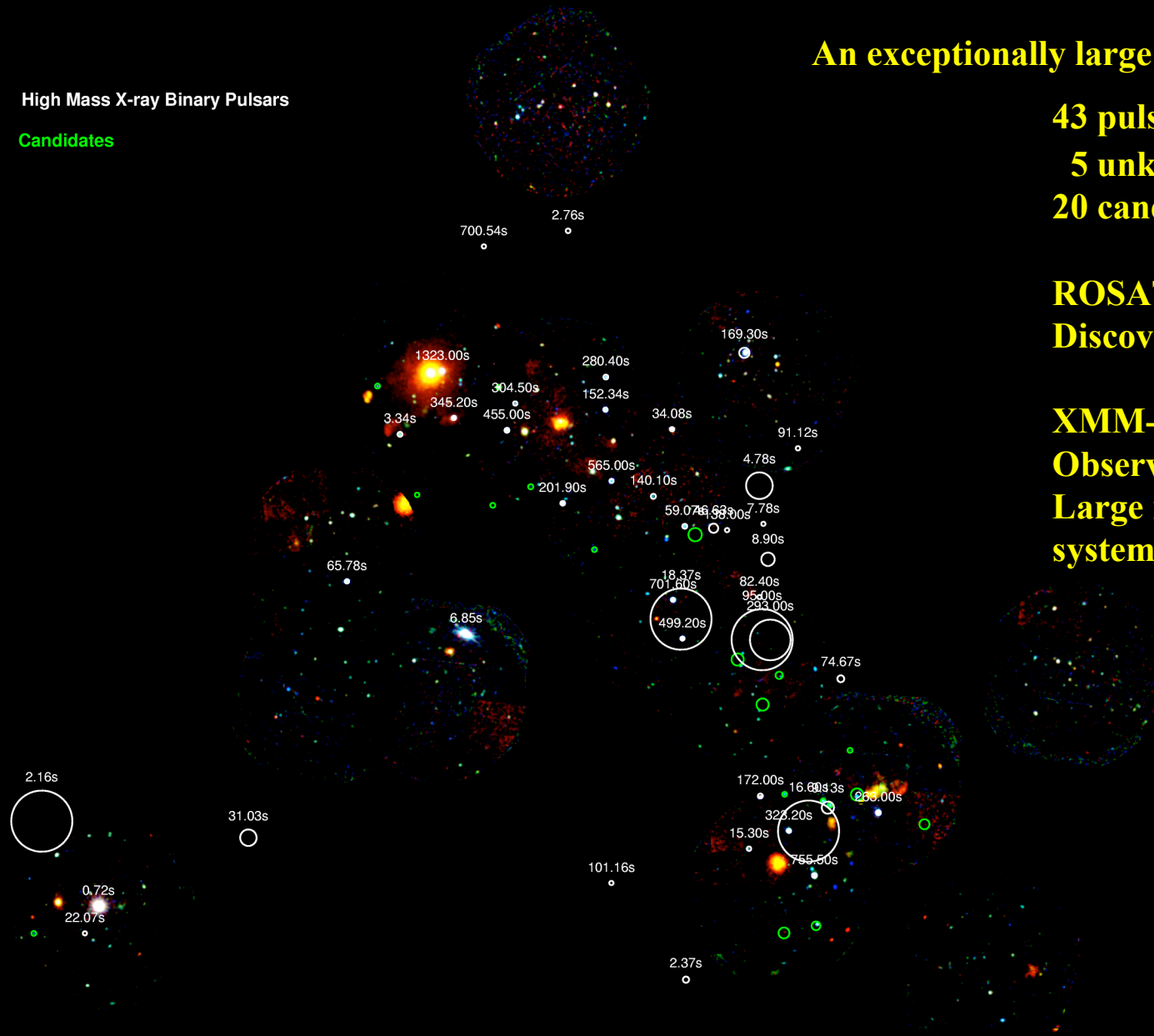
ROSAT, ASCA, RXTE

Discoveries during outburst

XMM-Newton

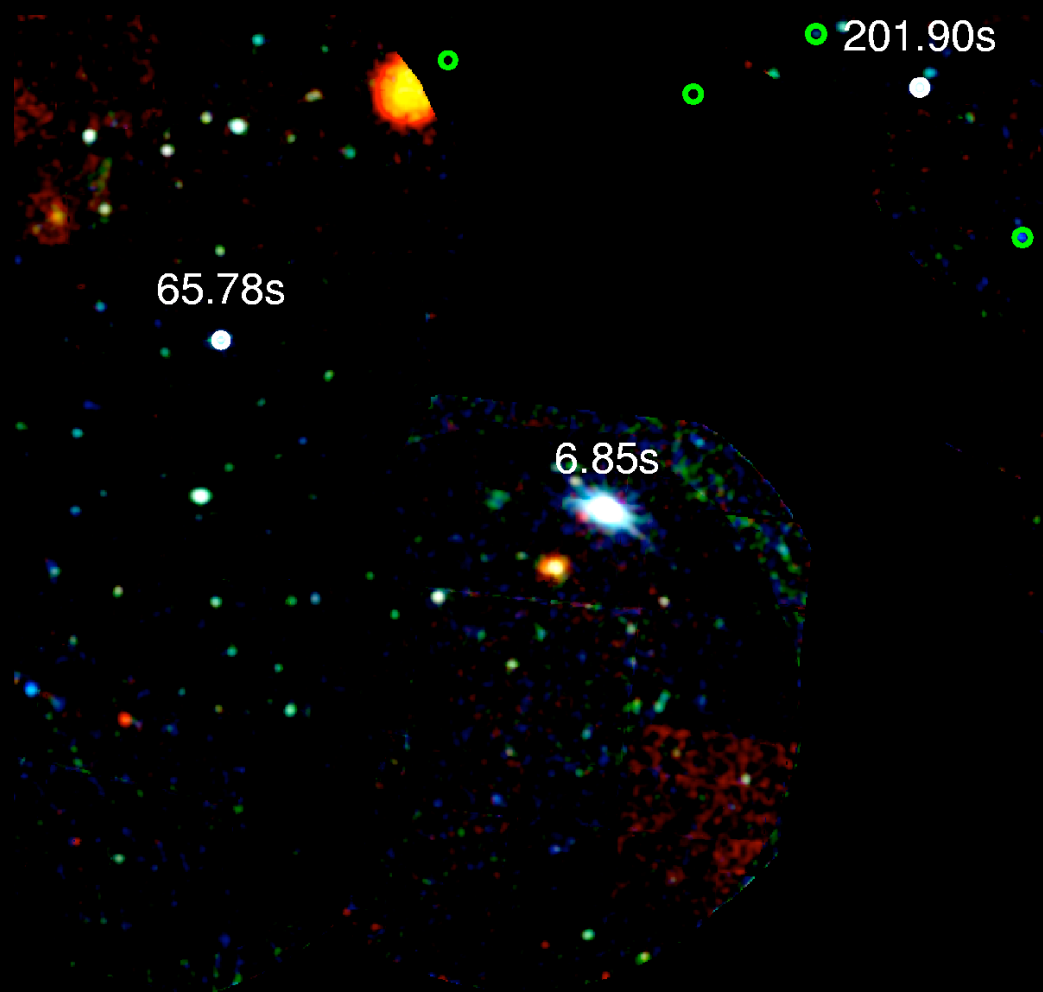
Observations at  $10^{34}$  ergs/s

Large number of persistent systems at this level





## Population studies III – High Mass X-Ray Binaries



**Observation 0402000101**

**X-ray transient  
with 6.85 s period**

**XMMU J010253.1-724433 =  
SXP6.85 =  
XTE J0103-728**

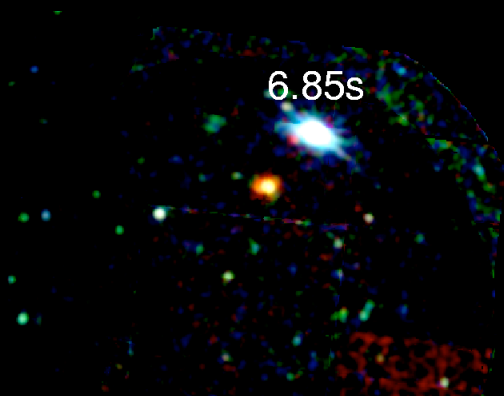
**improvement of position:**

**Star 054787 in Massey et al. 2002**

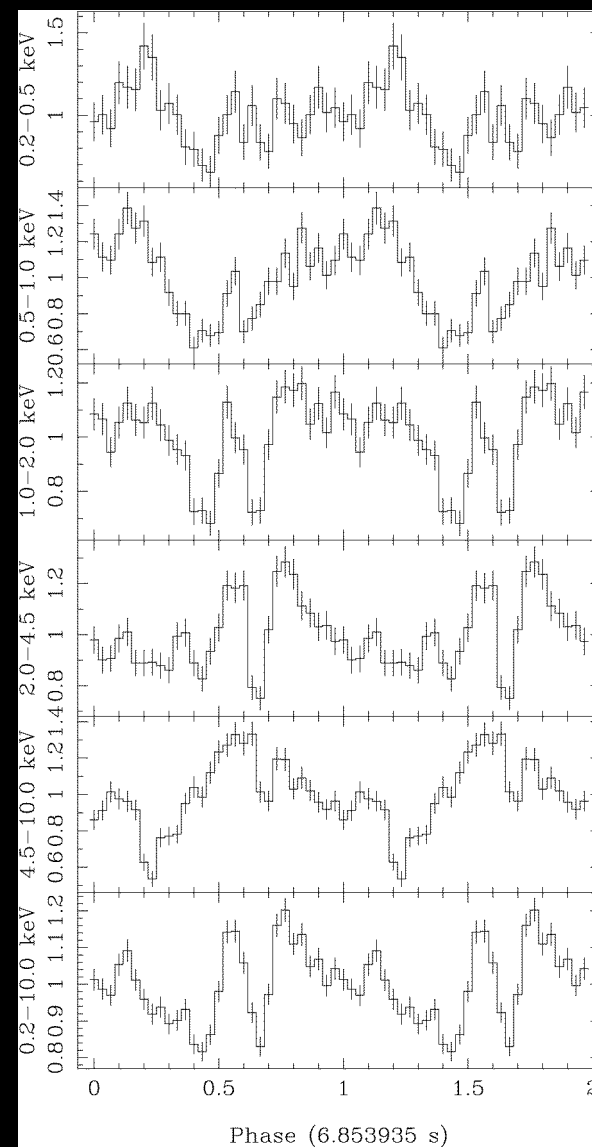
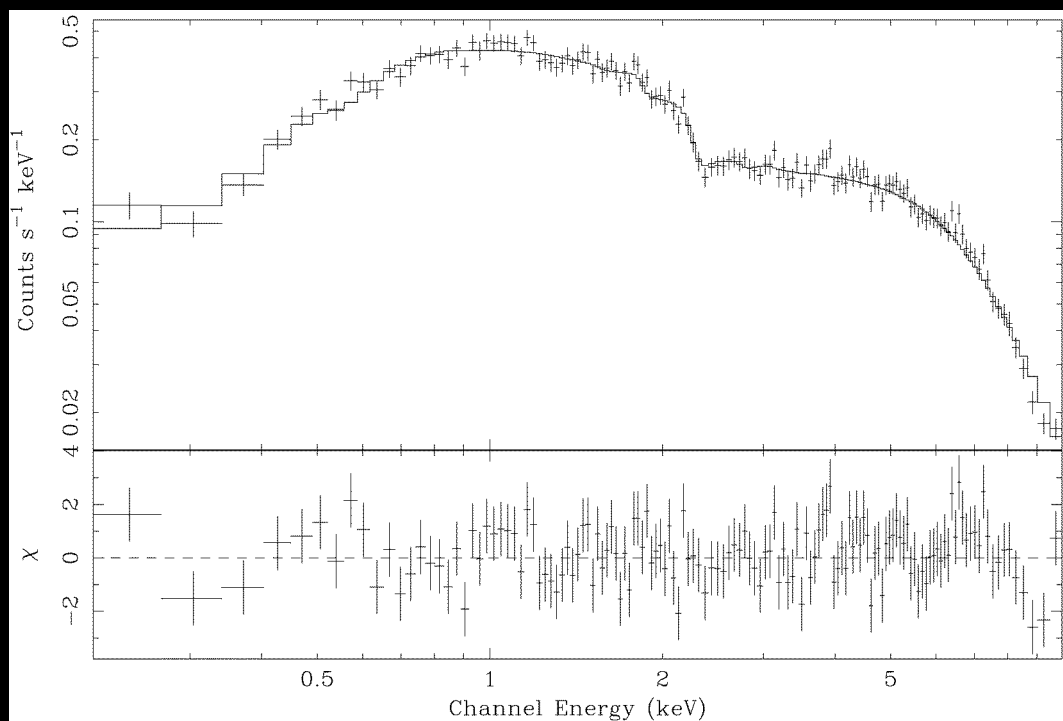
**$V = 14.59$   $B - V = -0.08$   $U - B = -0.96$**

**Be/X-ray binary**

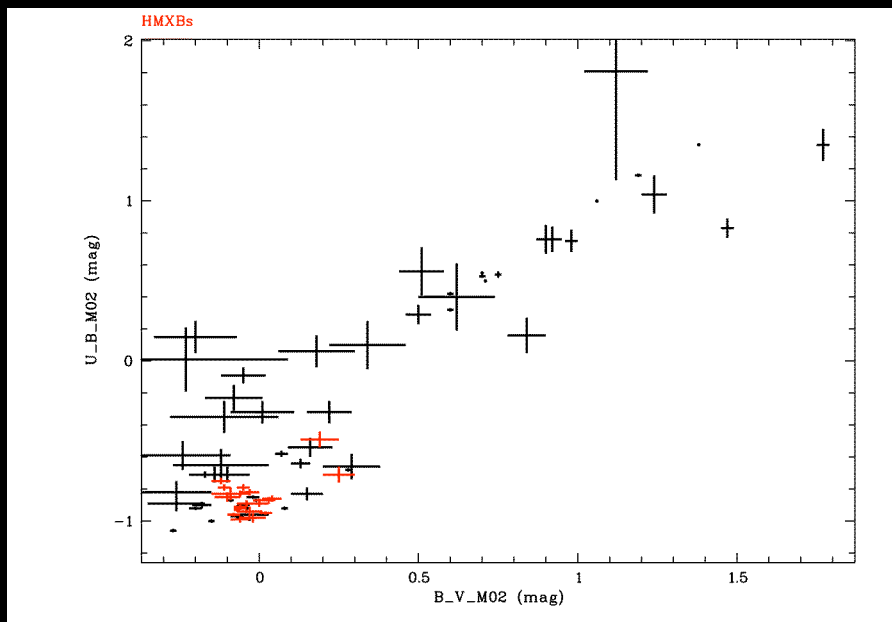
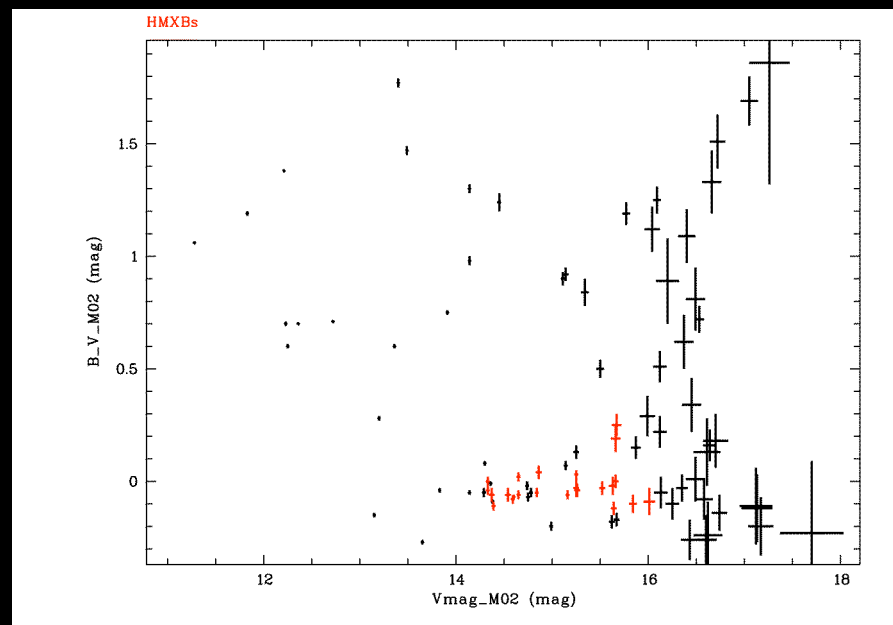
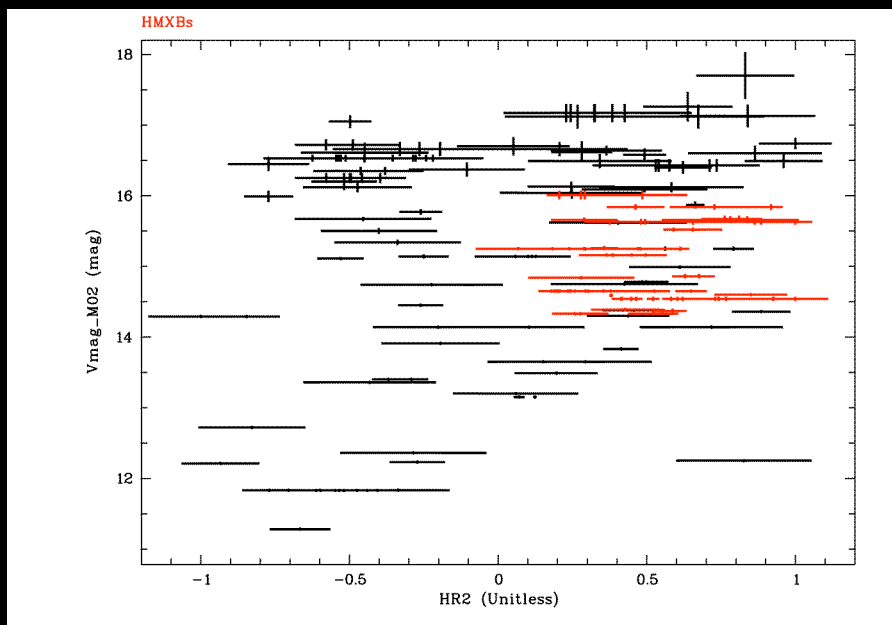
# High Mass X-Ray Binaries: The Be/X-ray binary pulsar XMMU J010253.1-724433



EPIC-pn:  
17.7 ksec  
1.4 cts/s  
 $L_x = 1.7 \cdot 10^{37}$  erg/s  
(0.2-10 keV)



# Selecting new candidates for High Mass X-Ray Binaries



New candidates for Be/X-ray binaries:  
X-ray + optical information

conservative selection:

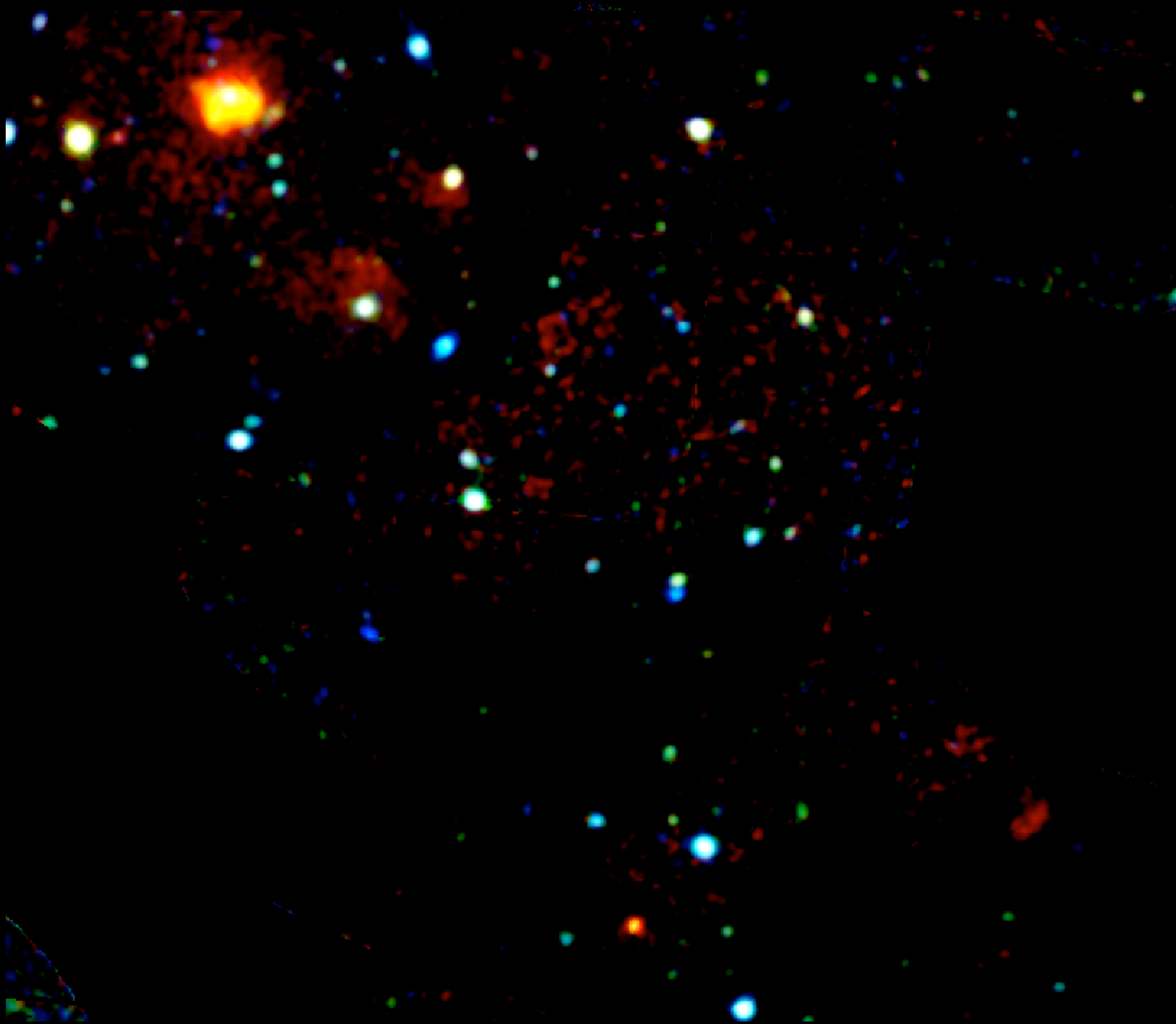
$HR2 > 0.2$

$-0.15 < B - V < 0.1$

$U - B < -0.8$

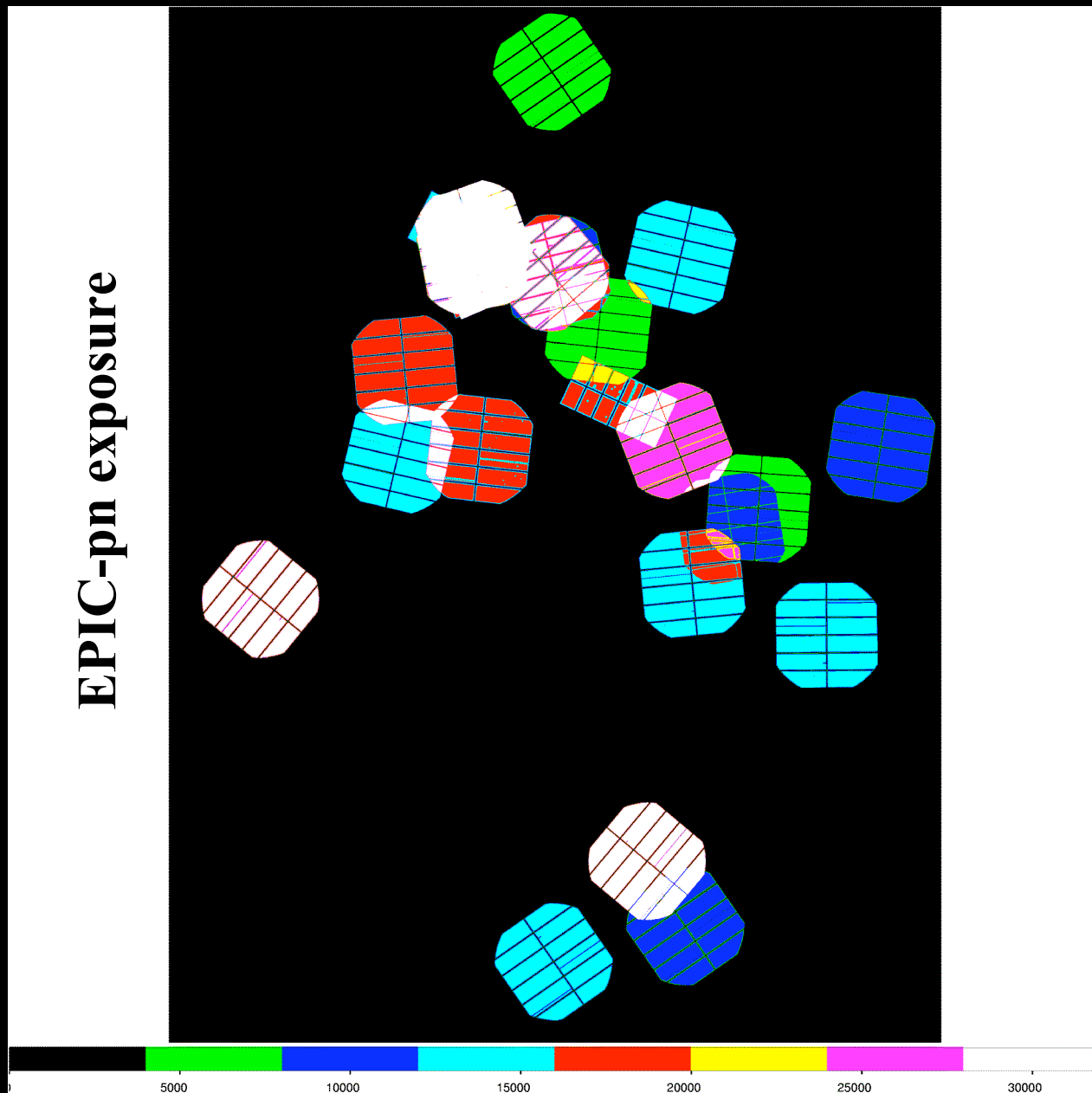
5 candidate Be/X-ray binaries

## Selecting new candidates for High Mass X-Ray Binaries



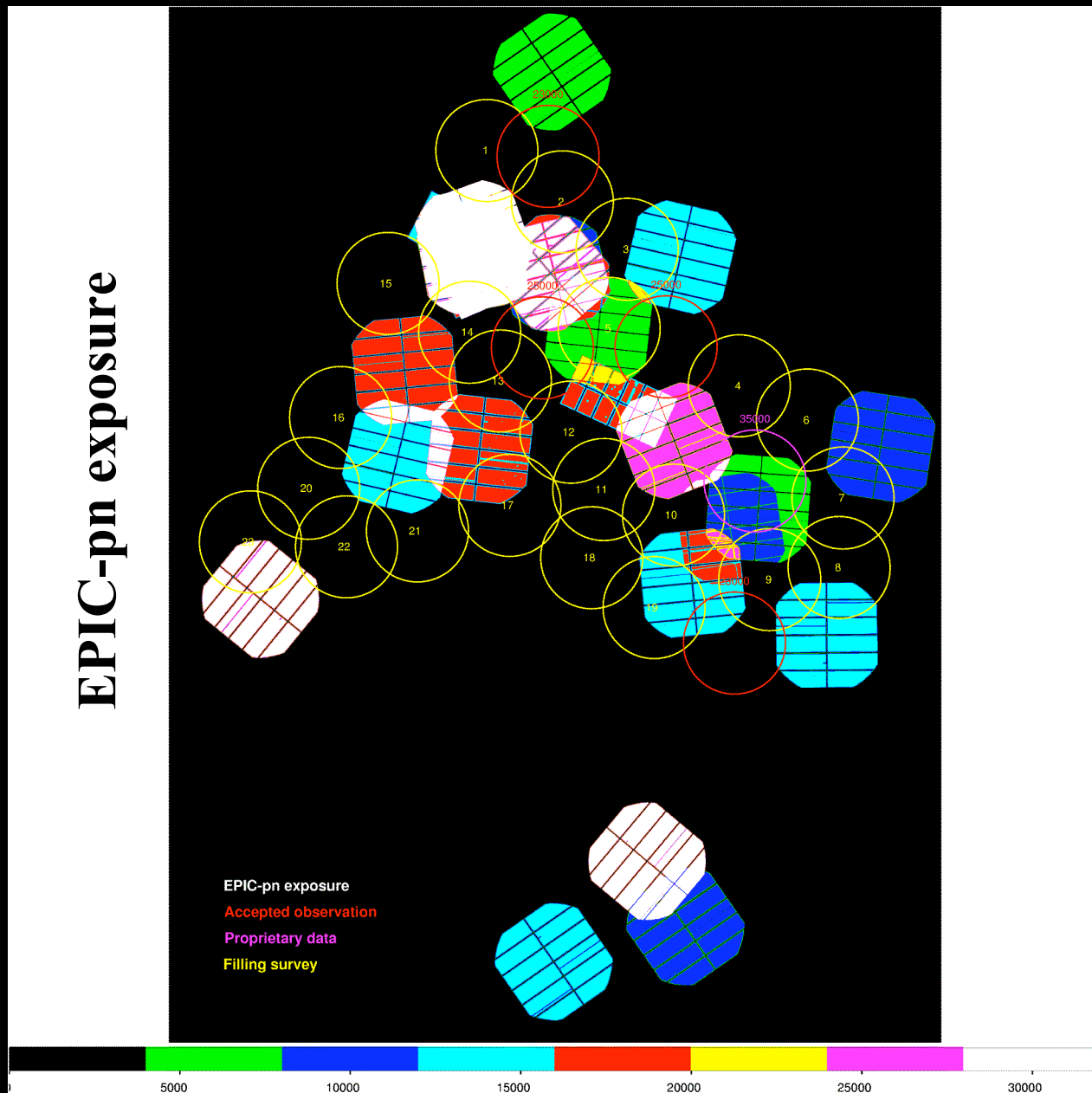


# An XMM-Newton survey of the SMC



# An XMM-Newton survey of the SMC

EPIC-pn exposure



SMC

23 Observations

30 ksec each

690 ksec total

Large Project

LMC

5 times bigger

3.5 Msec

For the next decade