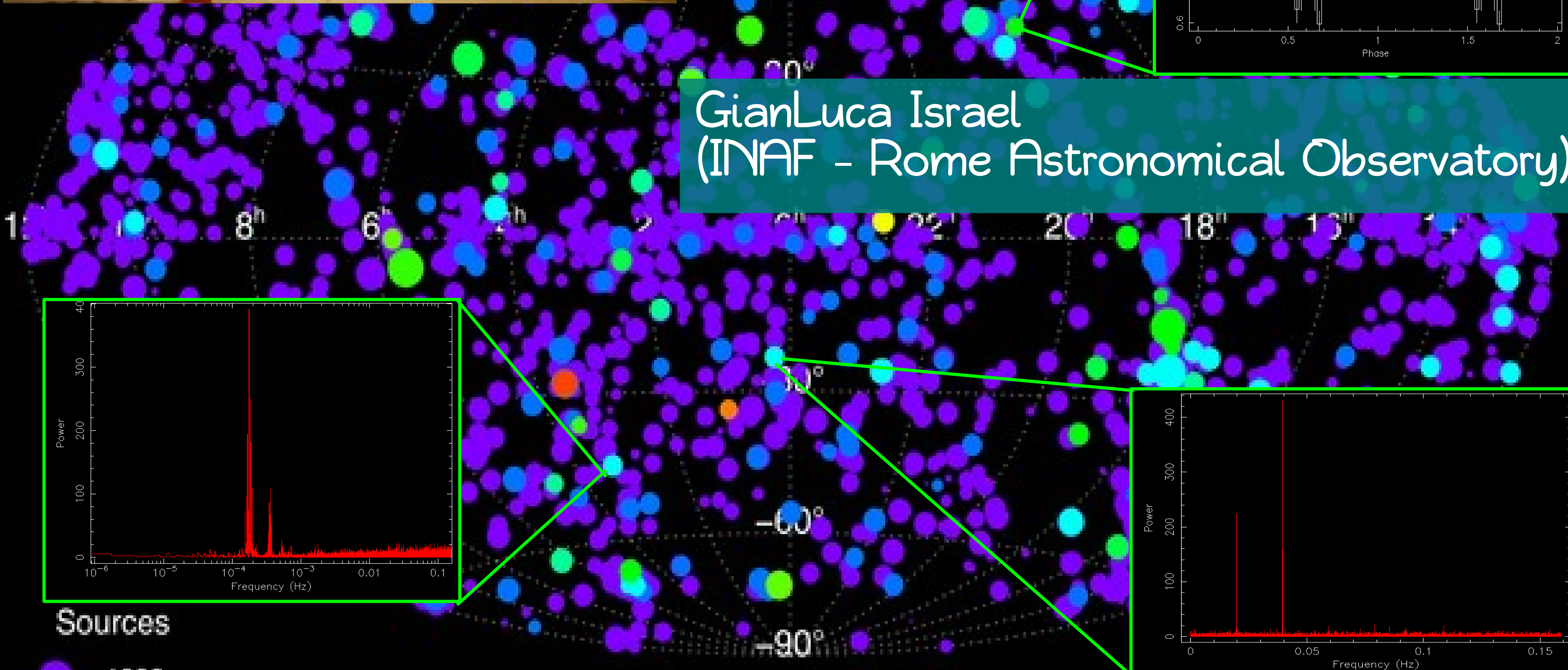
CATS@ EXTENDED EDITION



GianLuca Israel
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Collaborators: Esposito, Rodriguez, Masetti, Sidoli, Motta, Zampieri, Mason, D'Avanzo, Campana and others

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CATS@BAR

Chandra Acis Timing Survey @ Brera And Rome AOs:
an ad hoc pipeline (C-shell/Fortran) developed and applied in an automatic fashion to the ACIS archive (imaging obs. only).

First run in June 2012. Updated every ~2months

Main properties are:
- data retrieving
- exposure map creation and source detection (WAVDETECT)
- search for signals in sources with >150 events based on FFT (I&Stella '96)
  pros : fast and well known
  cons : not suited fo faint sources / non sinusoidal signals

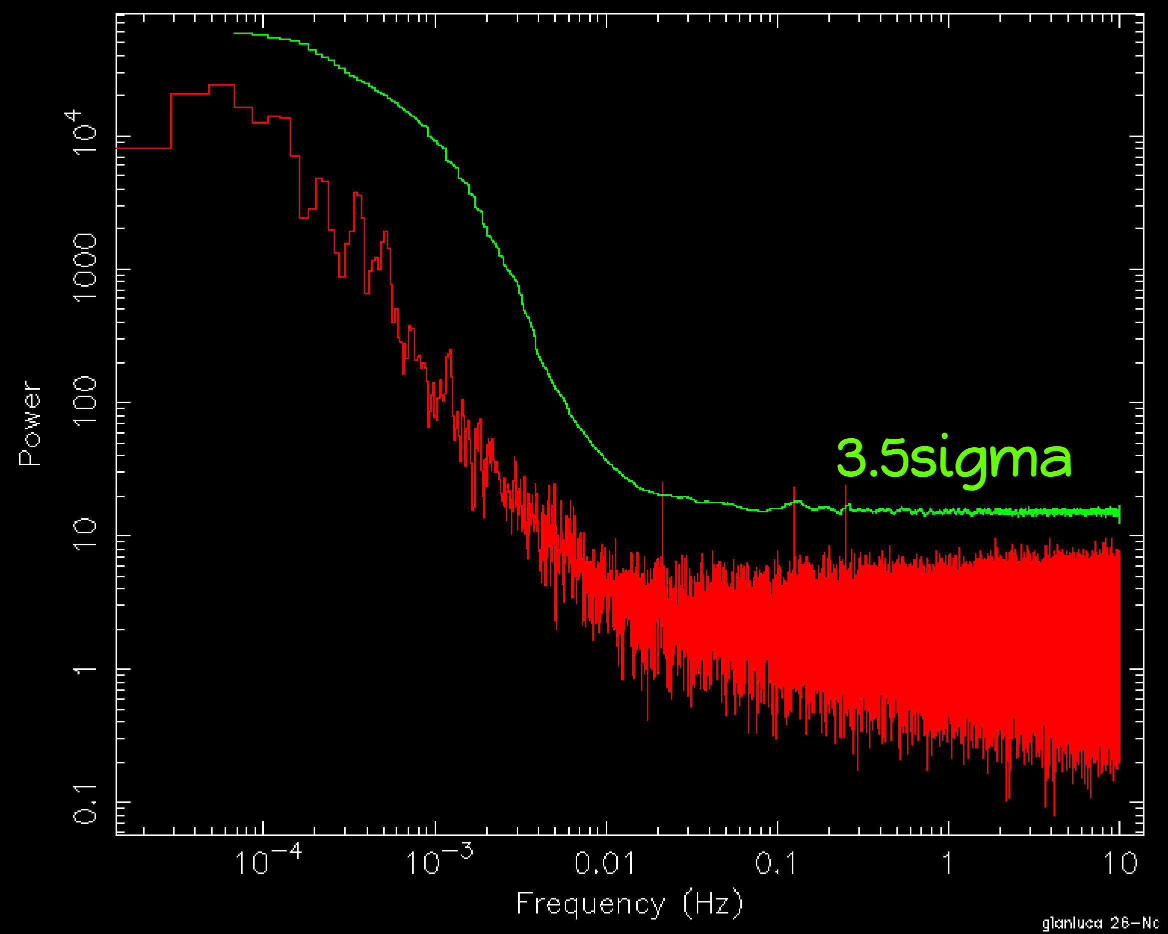
- assessment of signal goodness (instrumental vs real, DITHER_REGION ciao task)

HOW ?

Algorithm well suited for automatic searches of significant peaks in the presence of different noise components in PSD.

Limits: low sensitivity at low frequency and/or poor statistics.

Low sensitivity for non sinusoidal signals

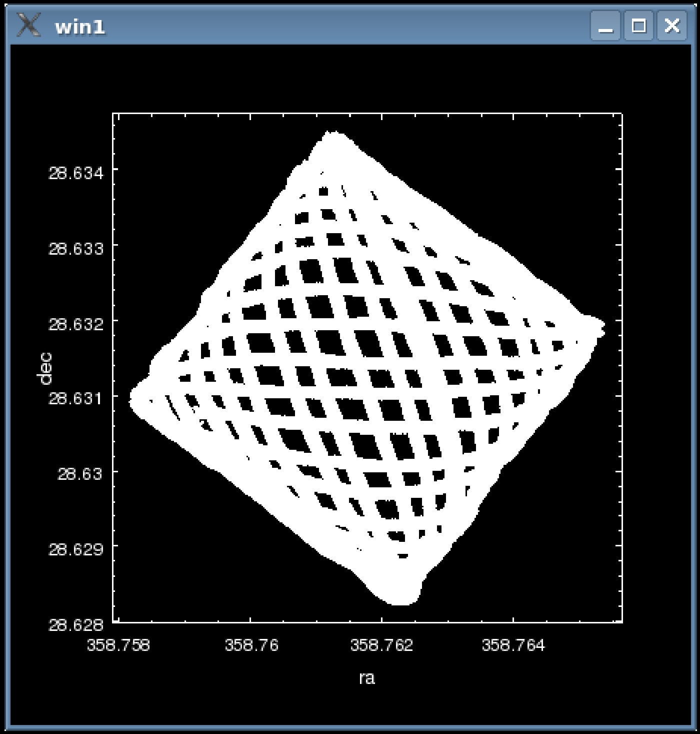


WHY CHANDRA ?

Only Chandra and XMM (and SWIFT) provides large enough throughput and good psf.

Chandra ACIS pros:
- very low BG level well suited to study faint sources;
- relatively long pointings in (very) crowded regions
- large number of serendipitous sources: ~45 src/field

...but it is definitely not suited for "timing" due to:
- dithering oscillations around the on-axis direction (pile-up mitigation);
- long sampling time, 3.2s in most cases (no sensitivity below P<6.5s)



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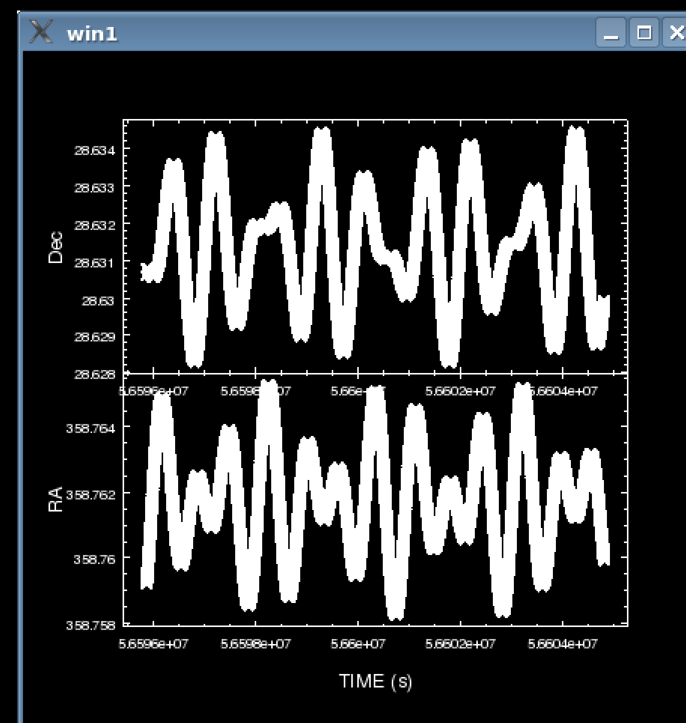


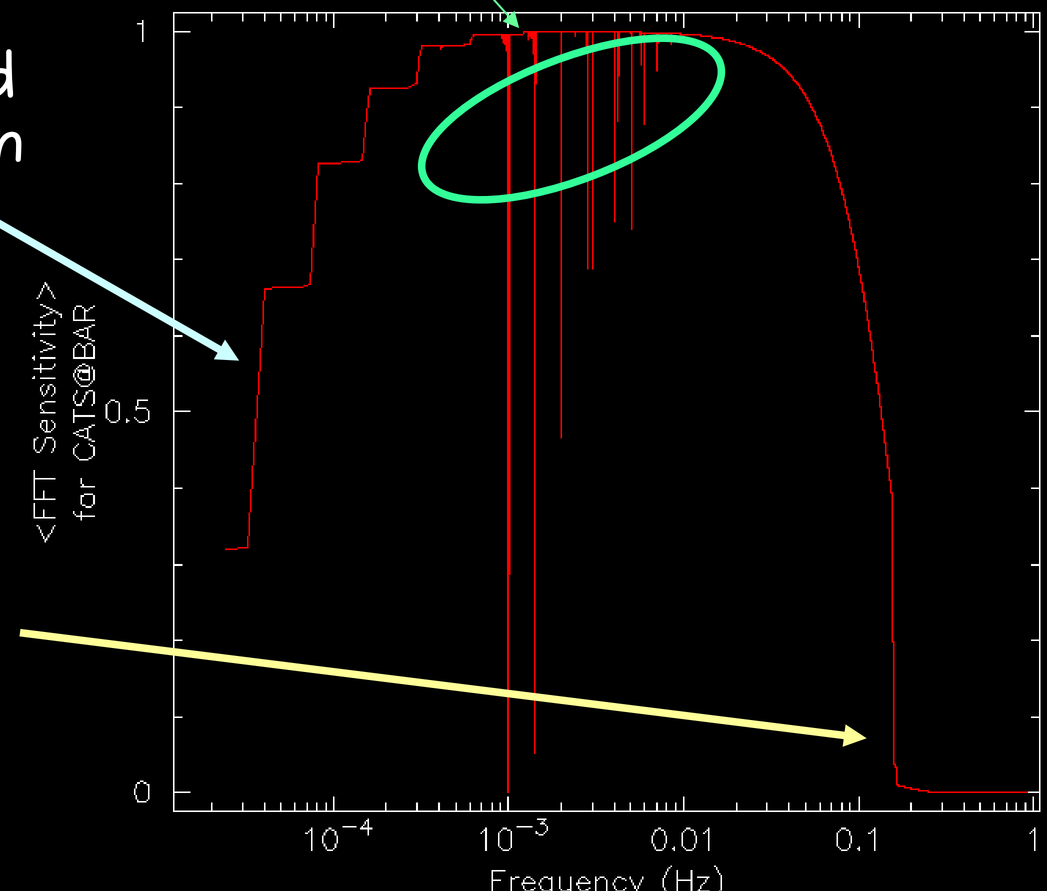
Detector	Peak-to-peak Span (arcsec)	Nominal Period in Y (s)	Nominal Period in Z (s)
ACIS	16	1000	707

SPURIOUS SIGNALS

By product: a complete catalog of serendipitous signals

Lower limit related to the maximum possible obs. lenght (satellite orbit) and capability of the detection algorithm

Upper limit related to the CCD sampling time (1/2Dt)

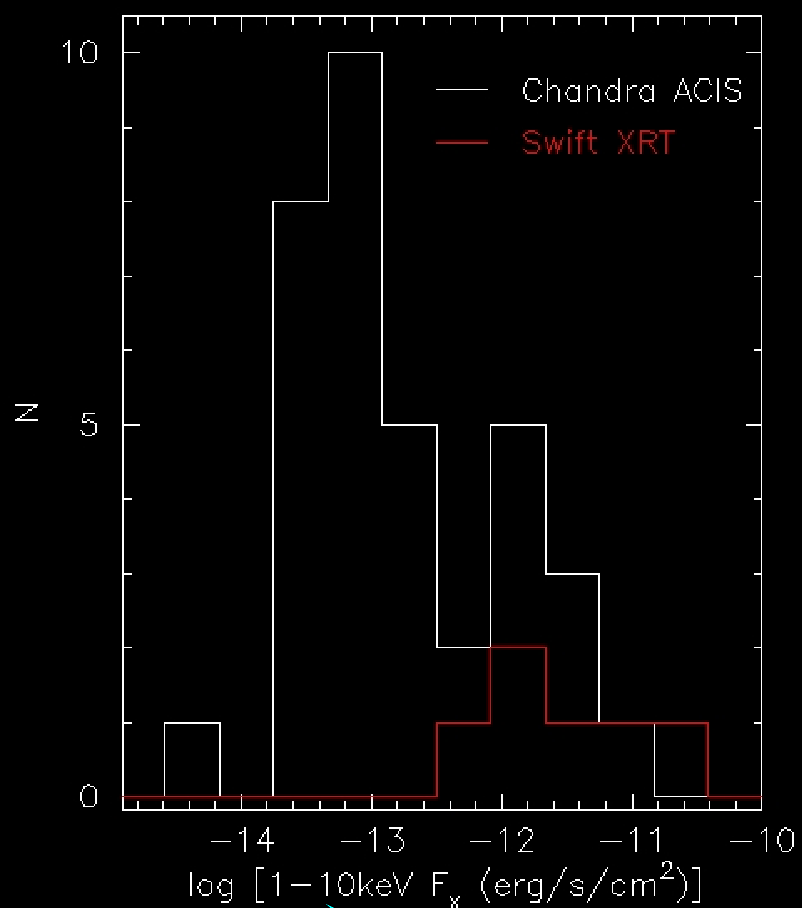


FEW NUMBERS AND STATISTICS

	Sep 2013	Sep 2015	Delta
Public observations	9000	10500	+14%
Analysed LCs	410000	470000	+13%
Detected peaks	150000	170000	+12%
New Pulsators	32	42	+25%
Fields / New Pul	280	250	
LCs / New Pul	13000	11000	

Approx. 3 new pulsators every year

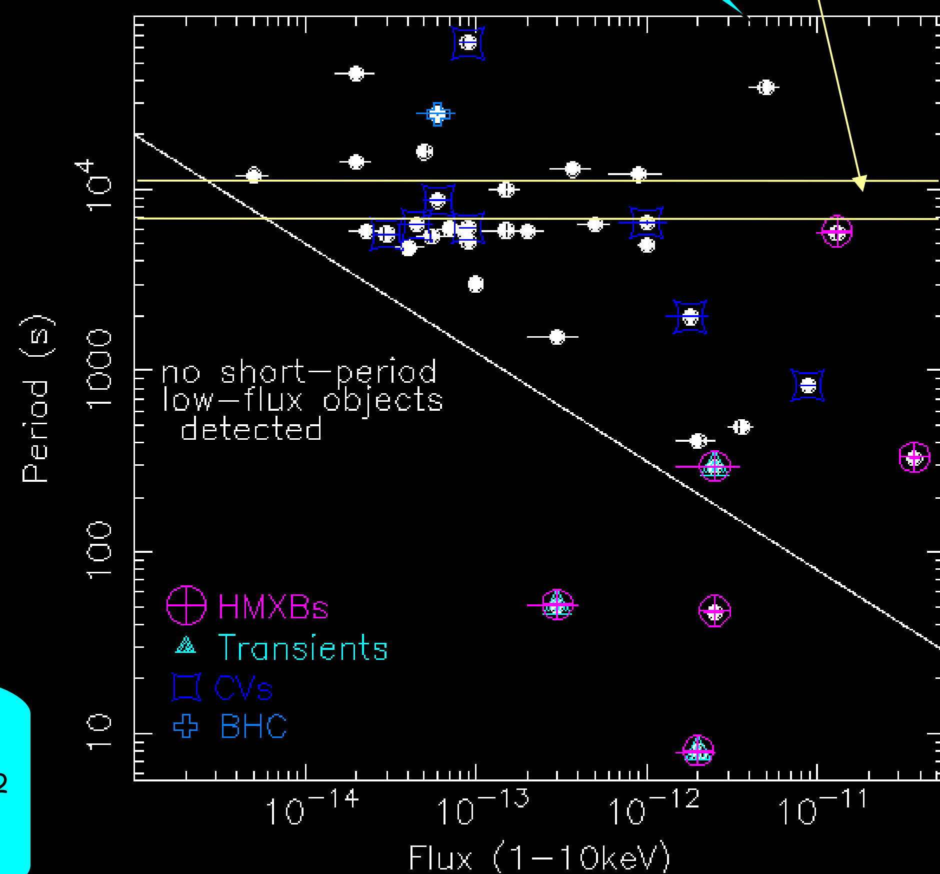
SAMPLE PROPERTIES



Fluxes peak in the ~$10^{-14}/10^{-13}$ erg/s/cm^2 range

Period-Flux anti-correlation.
Short period sources have higher fluxes (as expected...)

CV orbital Period gap



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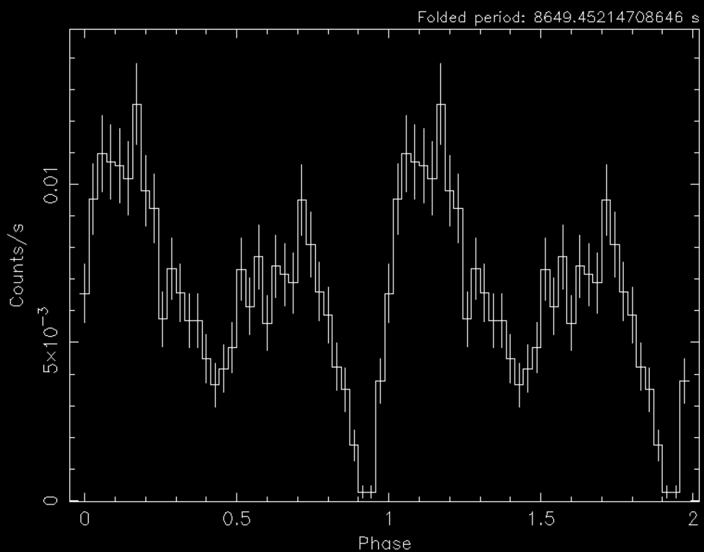
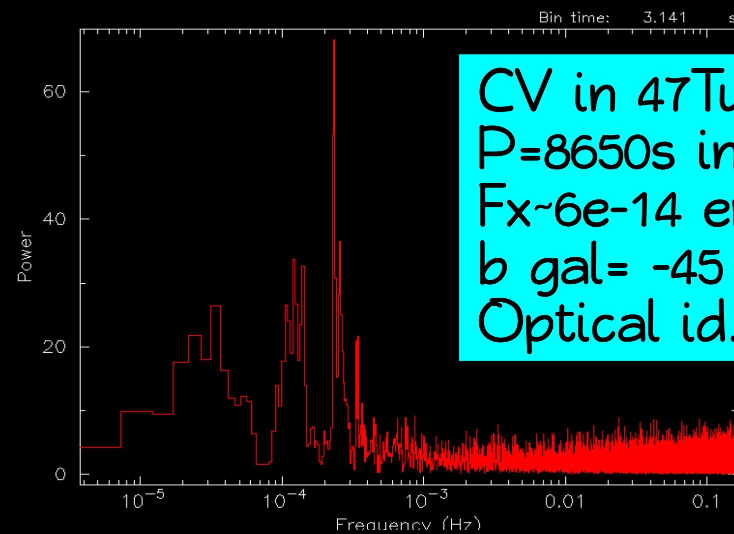
THE BHC SAMPLE

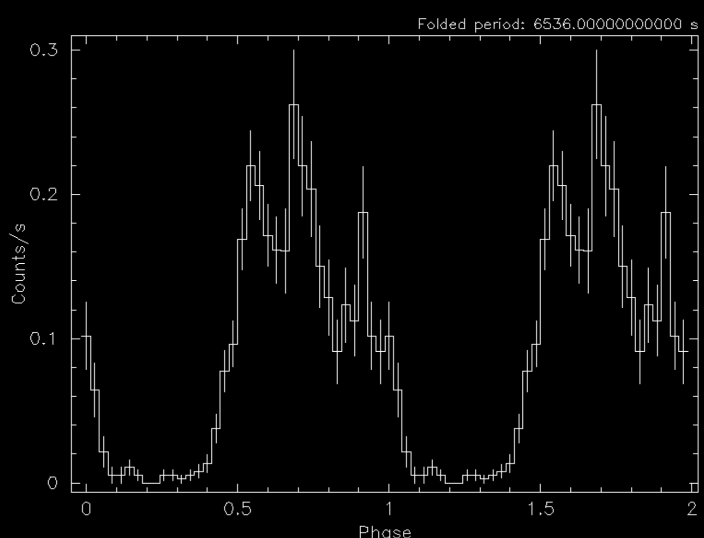
THE CV SAMPLE

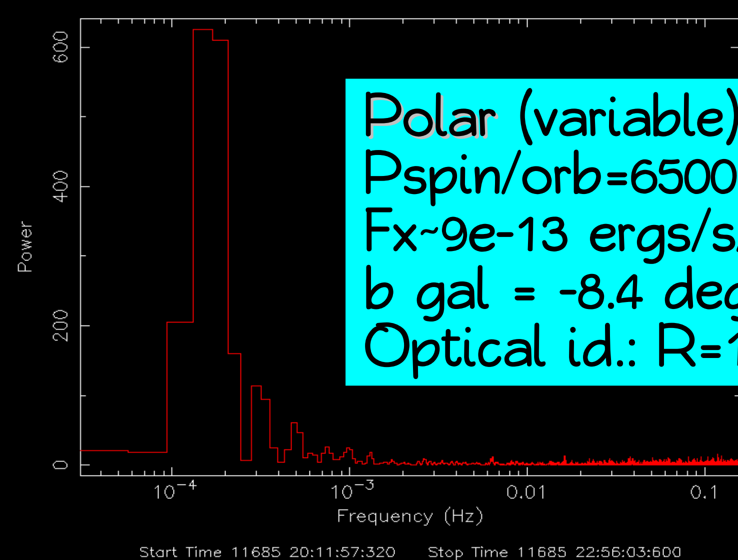
Likely the largest component in the sample.... two examples





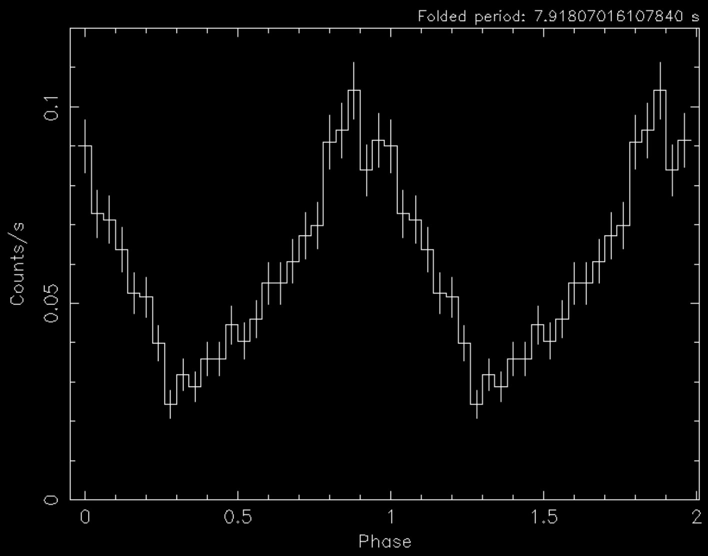
CV in 47Tuc
P=8650s in the period gap
Fx~6e-14 ergs/s/cm2
b gal= -45 deg
Optical id.: unknown

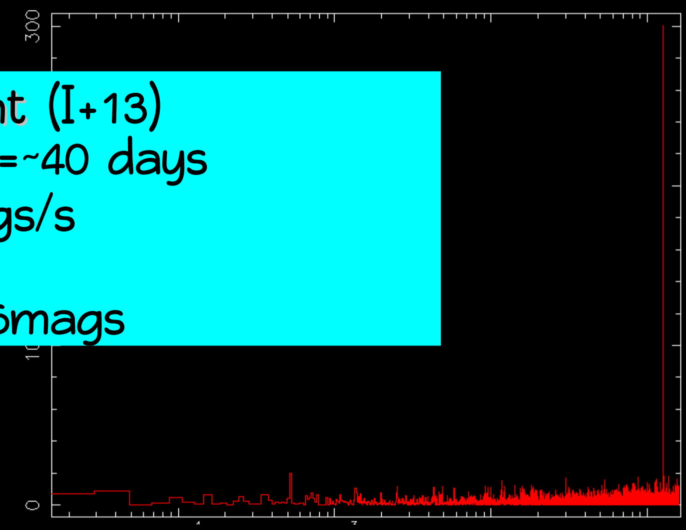




Polar (variable)
Pspin/orb=6500s
Fx~9e-13 ergs/s/cm2
b gal = -8.4 deg
Optical id.: R=17.5

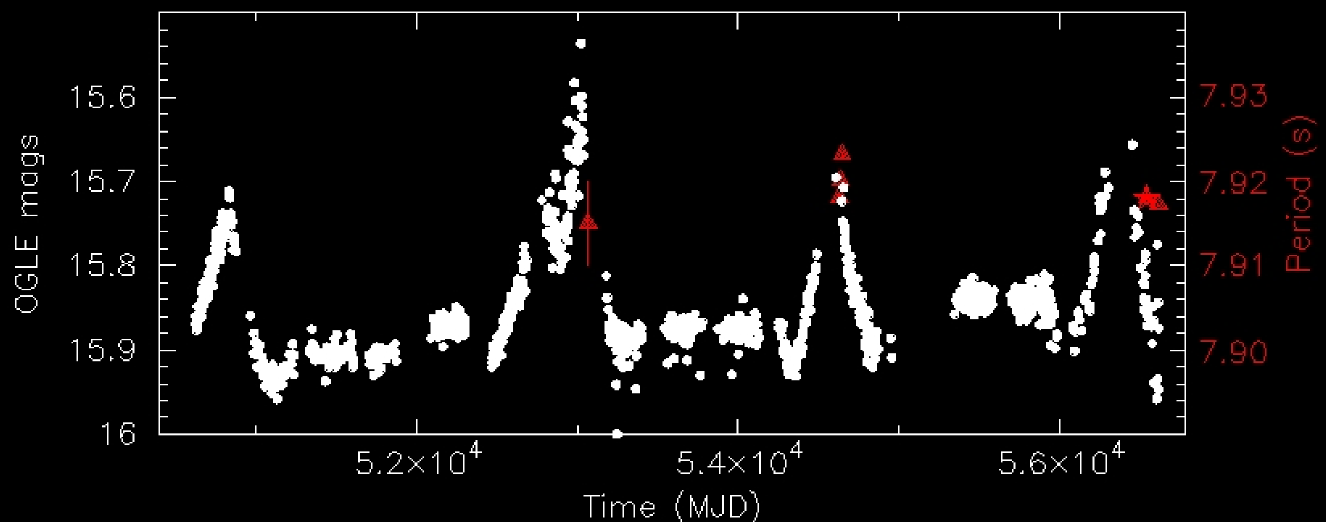
THE NS SAMPLE (THE FASTEST SIGNAL)





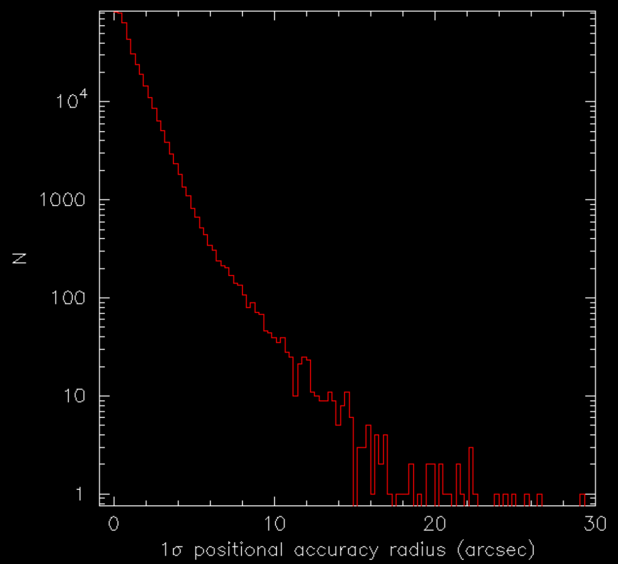
BeXRB, transient (I+13)
Pspin=7.9s Porb=~40 days
Lx~10^{35} - 10^{36} ergs/s
in the SMC
Optical id.: R=16mags

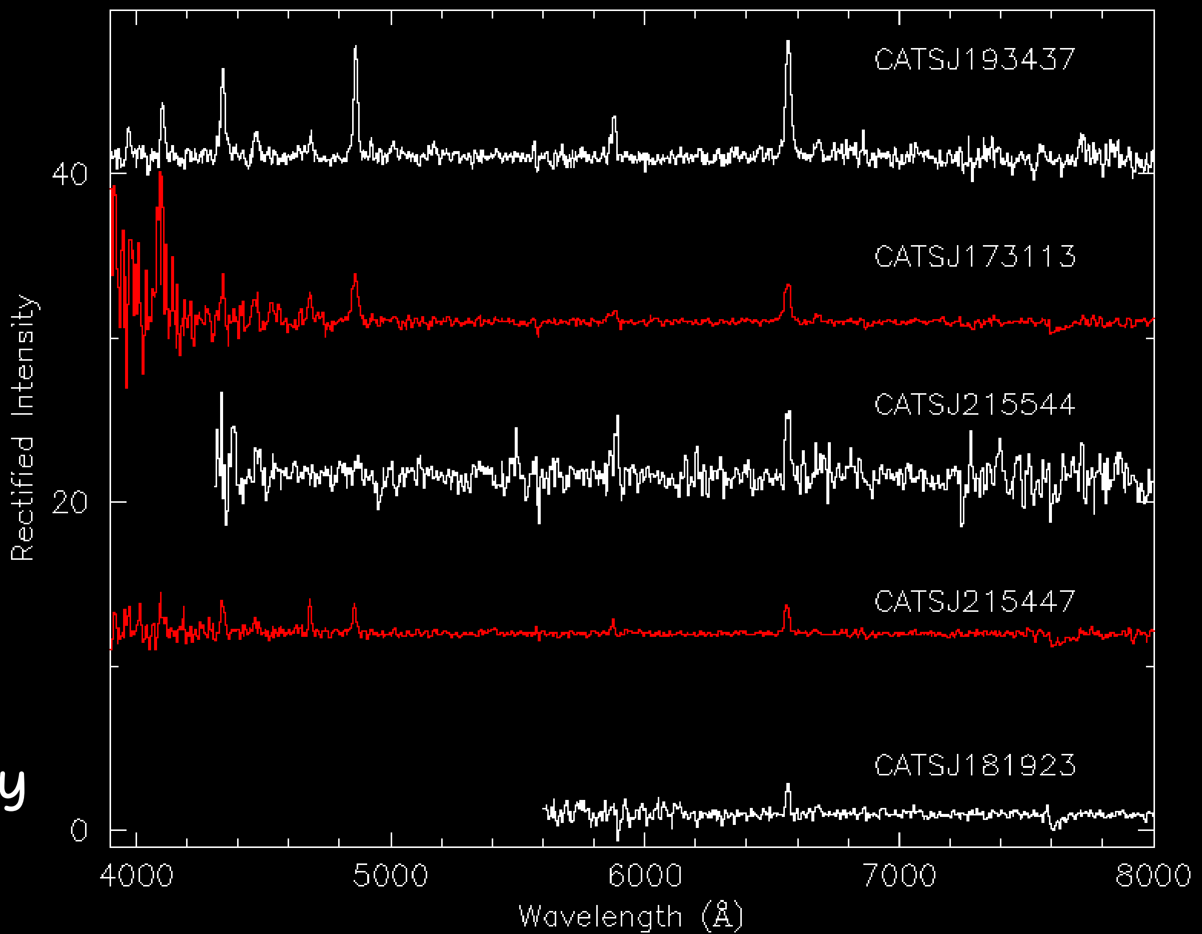
X-ray pulsations only detected during optical "flare" (circumstellar disk)



THE CLASSIFICATION PROCESS

Summary from 2 nights @ NOT during 2014





Large fraction of sources with positional uncertainty radius < 2″

THE FUTURE

- the CATS@BAR pipeline is applied to any new ACIS archival data every 2 months. 10-20 new pulsators are expected to be detected before the end of the mission (with FFT).

- Improvements: FFT is well suited for relatively strong and/or almost sinusoidal signal. Z^2-like algorithms (more suited for low-counts sources) will be applied to the archive in the future.
- X-ray/Optical follow-up: classification [XMM,NOT,LBT,SALT so far]

- EXTraS: an approved fp7 3-yr project (PI Andrea DeLuca) aimed at searching (among other aims) for new X-ray pulsators in the EPIC cameras.
  Expected results: extending the CATS@BAR sample towards shorter periods (sampling time in the 40-70ms). So far we found ~25 new X-ray pulsators

CATS VS EXTraS: PRELIMINARY