# The Survey Science Centre report to the XMM-Newton Users Group

# Natalie Webb



# **Topics**

- SSC activities
- The stacked catalogue
- Use of 3XMM-DR8
- Development : 4XMM
- Added value variability tests
- Summary

## **SSC Activities**

#### A great deal of catalogue work!

- Release of 3XMM-DR8 (16<sup>th</sup> May 2018, 775153 detections)
- Release of 3XMM-DR7s (July 2018, 71951 unique sources)
- A catalogue workshop (22<sup>nd</sup>-24<sup>th</sup> May, Toulouse, 64 participants)
- Release of SUSS-4 (November 2018, 8.17 million detections)
- A large investment in the preparation of 4XMM-DR9!

## **SSC Activities**

- Regular teleconferences with 8 SSC points of contact
- Continued SAS task development + support
- Continued data products screening
- Ongoing source identification activities
- Enhancement of catalogue servers
- Continued input into SAS and pipeline development via monthly SAS-CCB and SASWG meetings

## 3XMM-DR7s

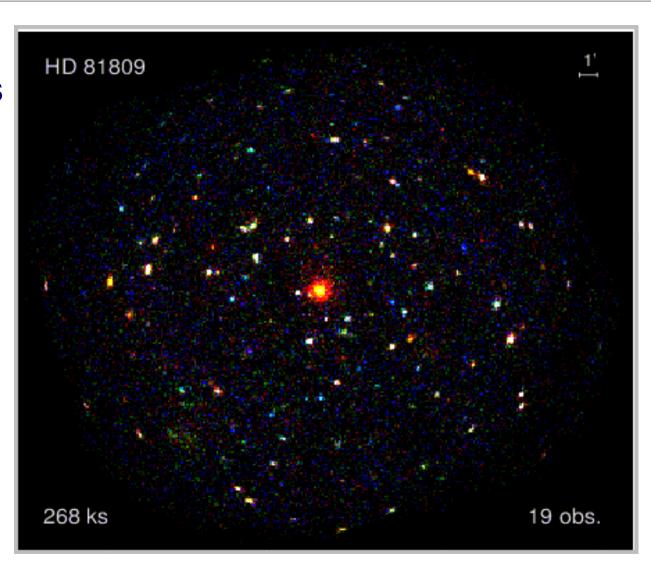


1789 observations

71951 unique sources

11043 new sources w.r.t. DR7

Traulsen et al. 2019

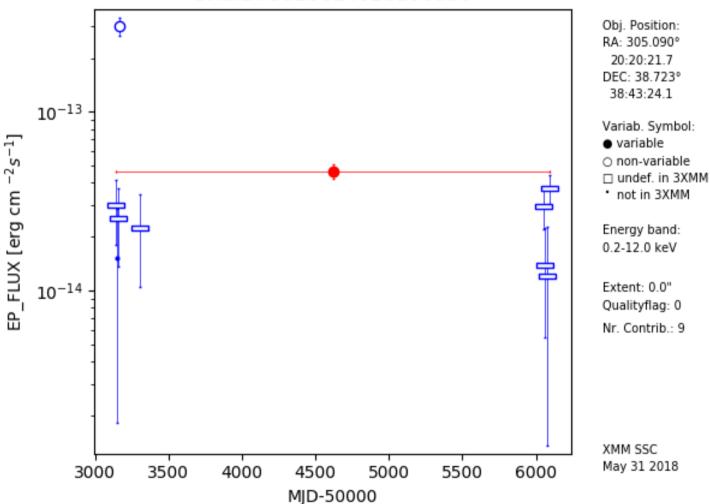




## 3XMM-DR7s





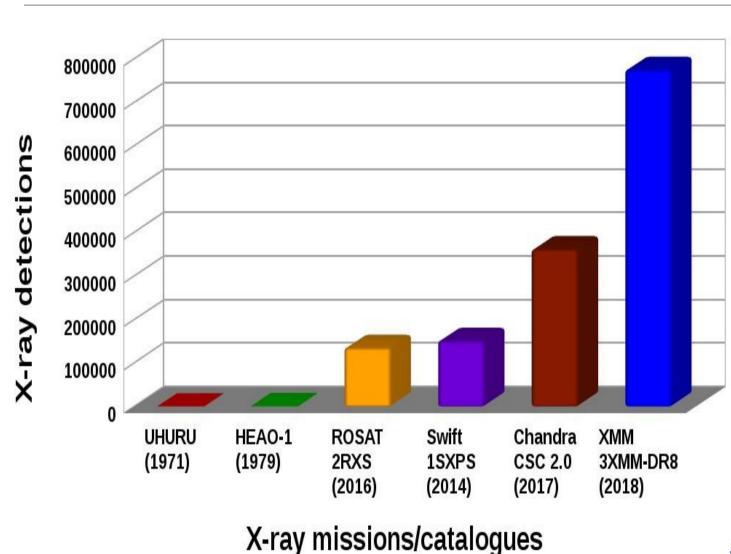


Traulsen et al. 2019



## 3XMM-DR8





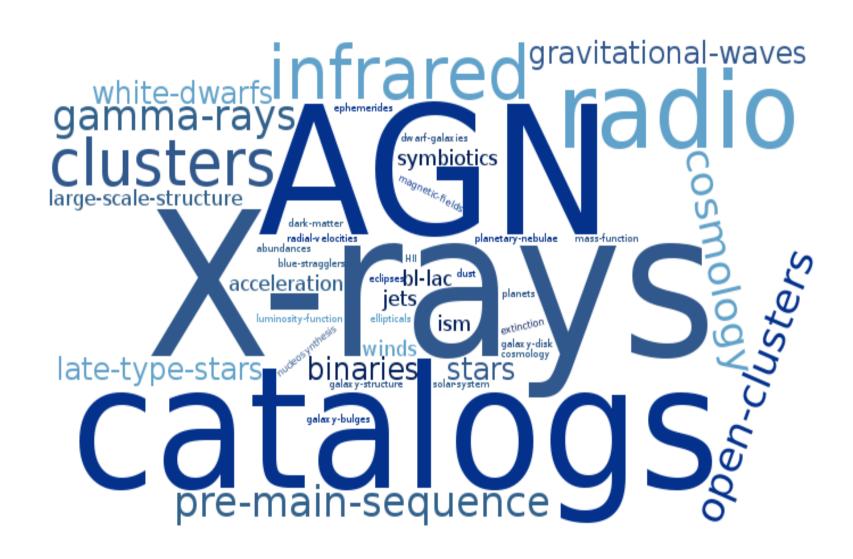
#### Excellent for:

- Quick access to data products (fluxes, spectra, images, etc)
- Finding new objects
- Population studies
- Multi-wavelength studies



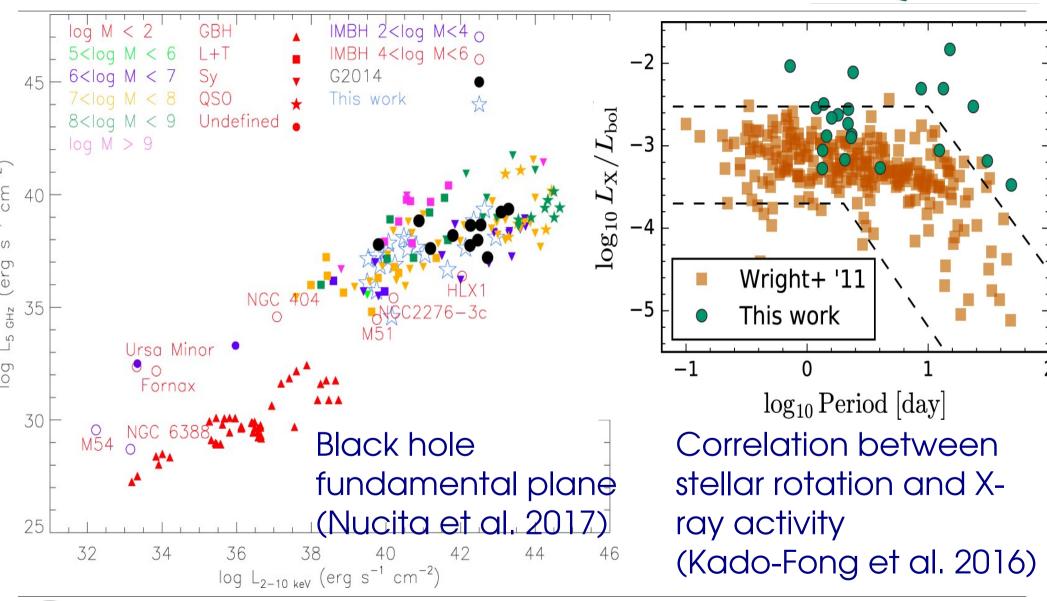
## **Use of 3XMM-DR8**





## **Use of 3XMM-DR8**







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## 4XMM-DR9

Data reprocessed using latest version of SAS

#### Changes since 3XMM:

- Spectra & light curves for pn Timing mode data
- Source detection, spectra & light curves for pn small window data
- Energy-dependent CTI, double-event energy corrections, time- & pattern-dependent correction of pn spectral energy resolution
- X-ray loading + rate-dependent PHA & CTI corrections for EPIC-pn
  Timing + Burst modes
- MOS spectra filtered with XMMEA\_EM & binning aligned with pn (5eV)
- Background taken from same CCD as source for EPIC spectra & Ic
- X-rays images and spectra correctly refer to the moving target
- New pile-up diagnostic numbers for EPIC sources
- Footprints for EPIC observations are provided as ds9 region files
- Improved calibration



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### 4XMM-DR9

#### Additional changes implemented for 4XMM-DR9:

- lightcurves to be binned to seconds resolution
- Background now calculated with smoothing method (not spline)
- KS test also used to evaluate variability (on non-binned data)
- systematic position for poscorok=F improved to 1.29" (from 1.5")
- new columns: EP EXTENT ML, SC EXTENT ERR, pileup eval., KS test results
- improved methodology to calculate SC\_EXTENT and FVAR
- improved pile-up estimate

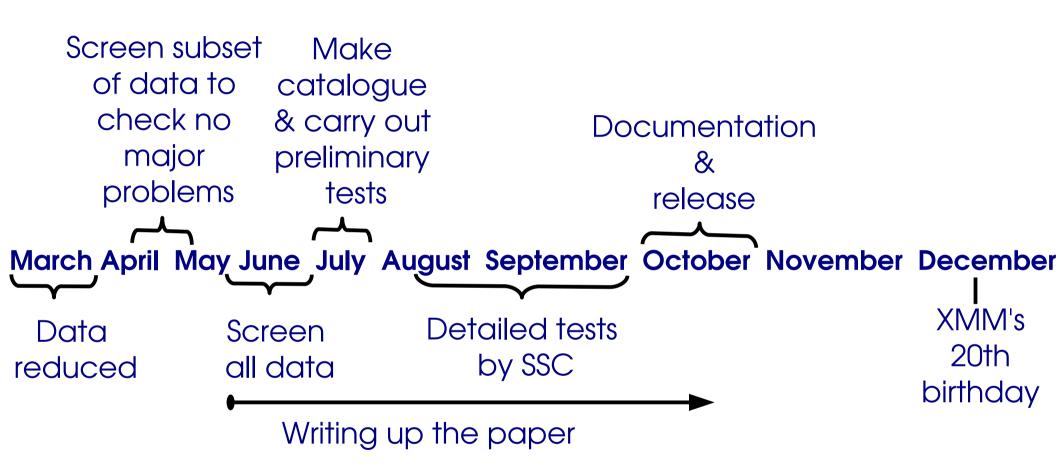
#### New products:

- radio to gamma-ray SEDS
- sky exposure to be provided for all catalogue
- new version of stacked catalogue



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## 4XMM-DR9 – tentative schedule



# Added value variability tests

 $\chi^2$  & fractional variability tests on **detected** sources (>100 ct)

Some sources vary very rapidly ( $\gamma$ -ray bursts/ gravitational wave events, type I X-ray bursts, possible counterparts to FRBs etc)

Distant (faint) sources may have few counts, all concentrated over a few seconds and not detected in a long observation

To exploit all data, search whole field on short (3-100s) timescales

New methodology developed (Pastor Marazuela et al. to be sub.)

2849 variable sources of which ~2000 uknown objects

Extras used 3XMM-DR5, 1000 ≤ binsize ≤ 5000 s, result = 136 transients



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# Added value variability tests

Highly variable sources from observation to observation:

- gravitational wave events  $\gamma$ -ray bursts cataclysmic variables
- tidal disruption events supernovae .....
- X-ray binary outbursts magnetars

Code developed to identify highly variable sources in XMM-Newton data, including non-detections (Astiasarain in prep.)

Continued development to provide preliminary identification

100s good quality sources varying by over a factor 10 in the catalogue

Aim to provide these new identifications for release of 4XMM-DR9



## Summary

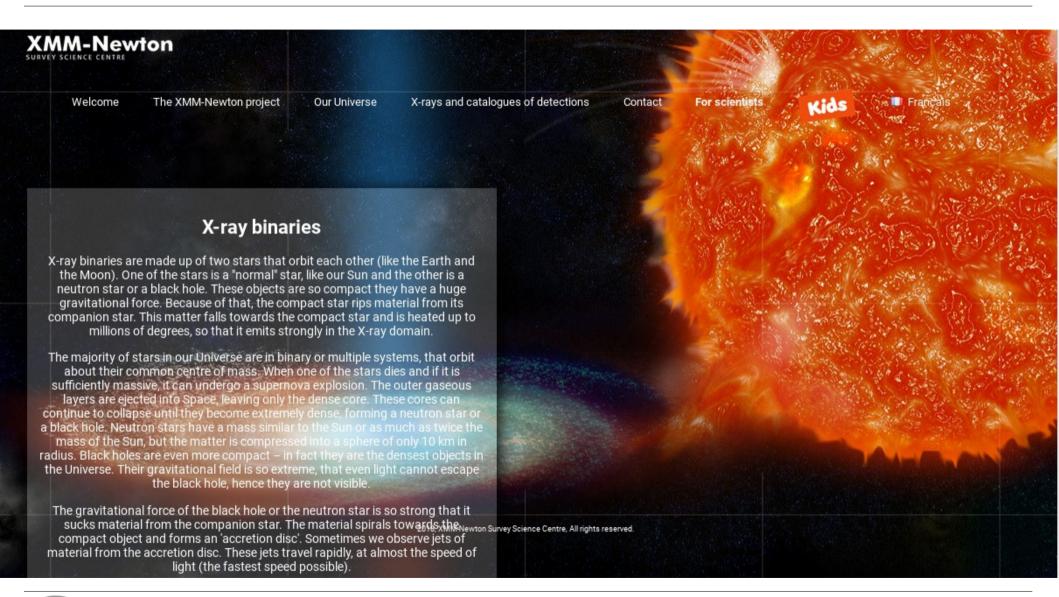
- Continued SAS task development + support
- Continued data products screening
- Ongoing source identification activities
- First release of stacked source catalogue
- Enhanced catalogue servers helping to disseminate data products
- Production of 4XMM started for release at the end of 2019
- Incremental yearly updates of 4XMM + stacked catalogue foreseen
- New methodology developed to provide added variability info.



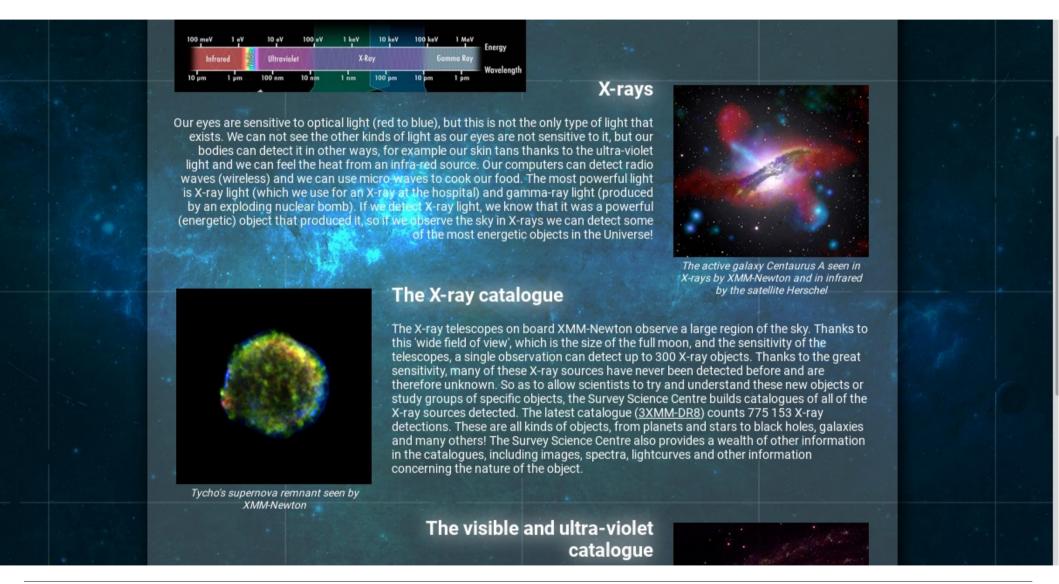
Thanks to strong support from SSC members and the SOC, we are continuing to provide XMM-Newton legacy products to the astronomical community



# Outreach pages



# **Outreach pages**



# **Outreach pages**



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