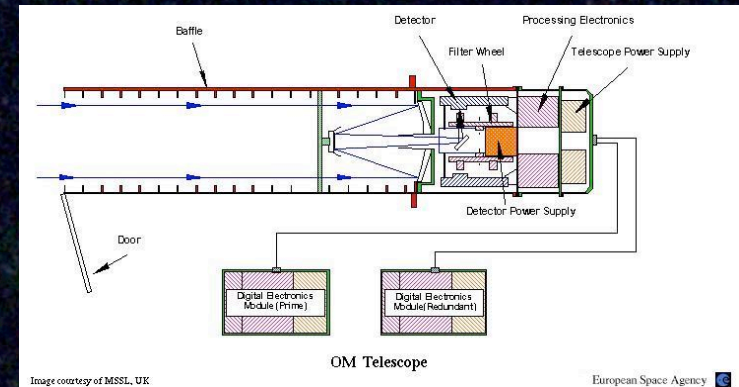


XMM-OM: future operations

XMM: the next 10 years, ESAC 2007



**Mat Page, MSSL-UCL
on behalf of MSSL and ESAC OM teams**

Contents:

- XMM-OM status and performance.
- What are people using it for?
- Instrument health and future sensitivity.
- OM in a slow slew survey.
- What should we use OM for in the next 10 years of extragalactic surveys?

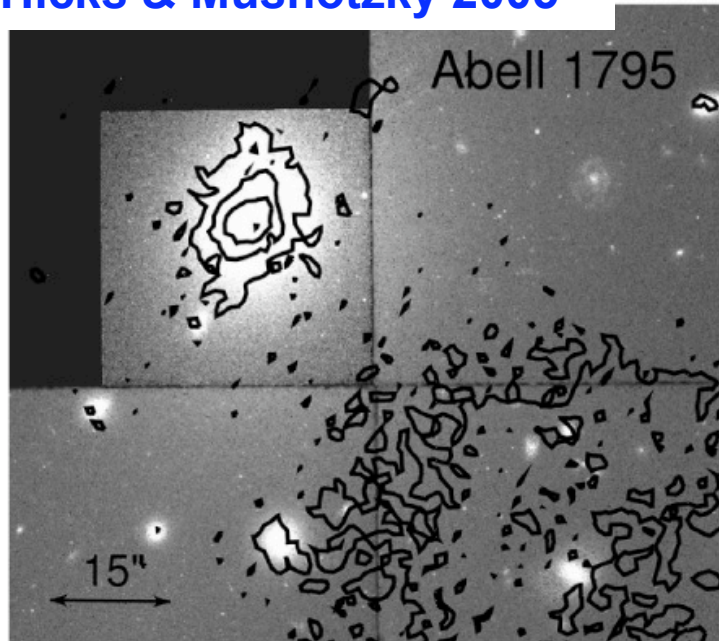
XMM-OM overall status and performance

- XMM-OM continues to function nominally.
- Though its not perfect:
 - Reduced throughput below 2500A.
 - Scattered light produces artifacts near centre of FOV.
- Returning good quality optical and UV data.
- The calibration is in a very good state.
- Producing excellent science.

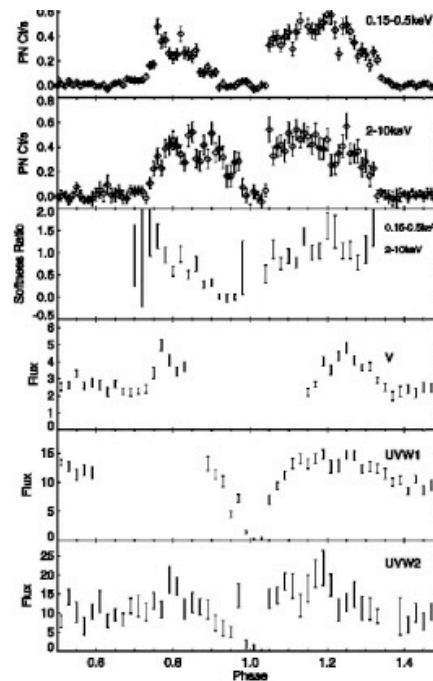
XMM-OM is in good shape.

What are people using XMM-OM for?

Hicks & Mushotzky 2005

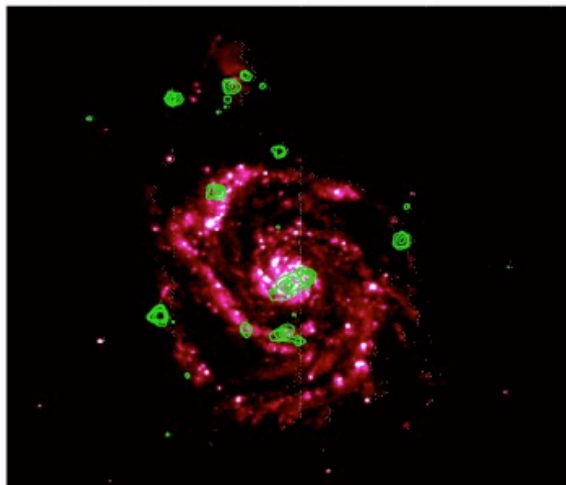


Ramsay et al 2004

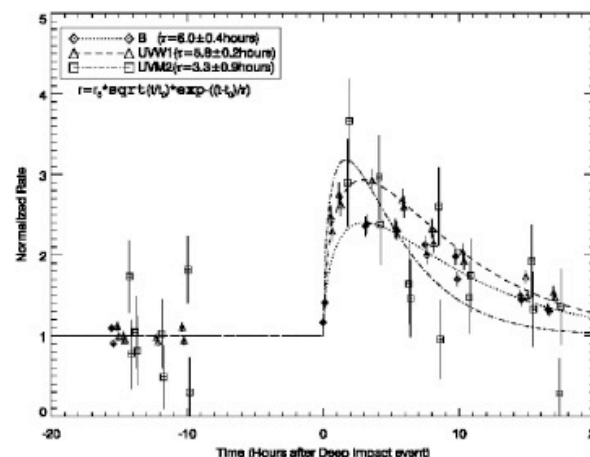


All sorts of things!

- Star formation in cooling-flow clusters
- Accretion flows in accreting binaries
- Ice grains in Comet 9P/Tempel 1
- Comparing X-ray populations to star formation regions.



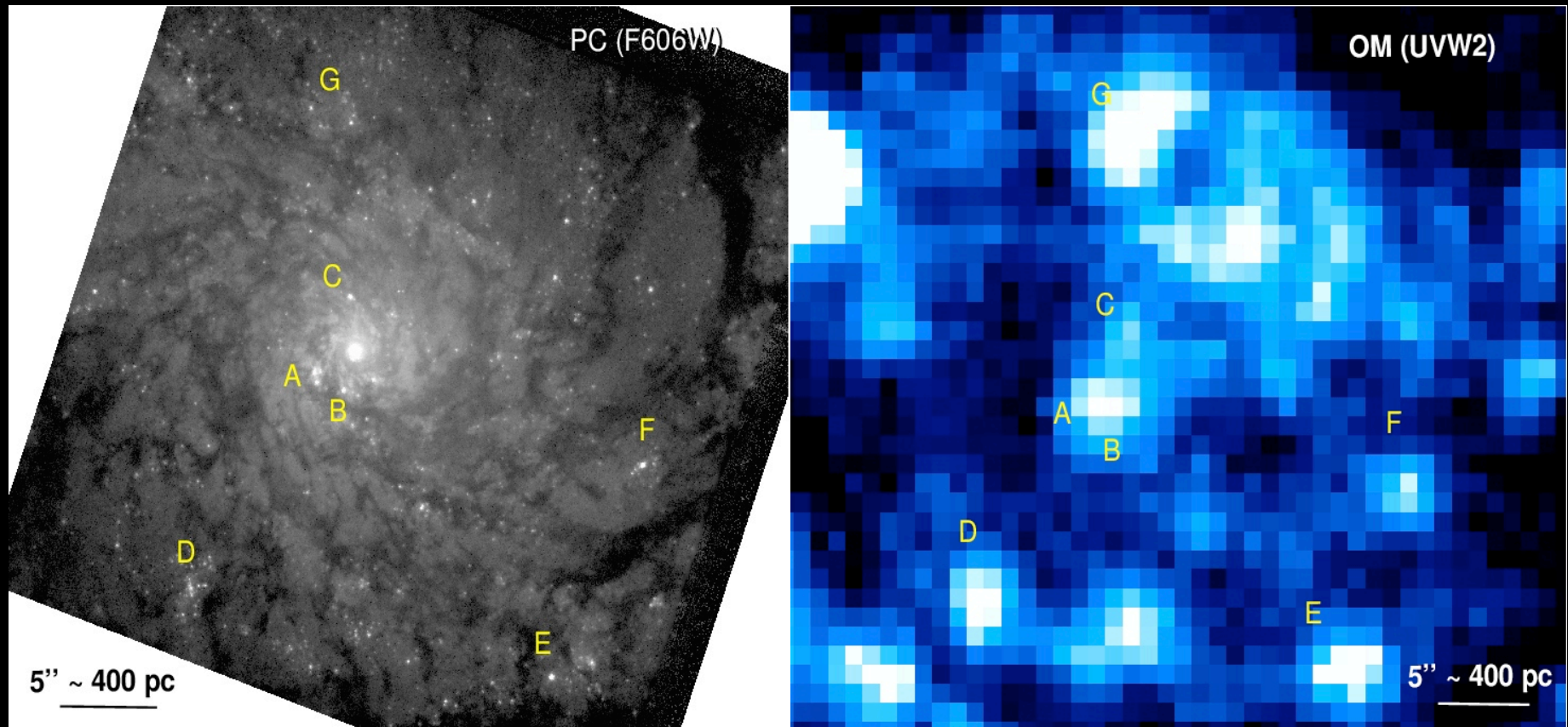
Dewangan et al 2005



Schulz et al 2006

Nice recent example:

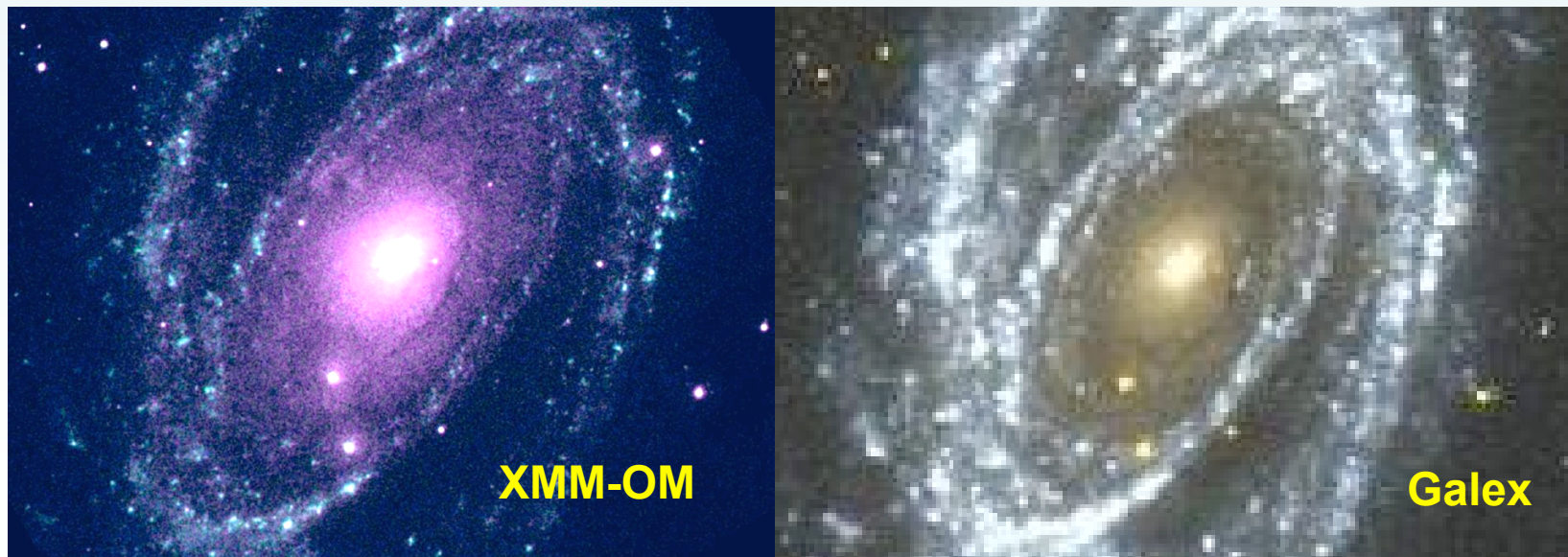
Soria et al. 2007, ULXs and star formation in M 99



OM UV imaging used to work out the ages of the star clusters.
No young stars in the nuclear star cluster!

UV capable observatories currently in orbit*

	XMM-OM	UVOT	Galex
FWHM	2.0"	2.2"	5"
FOV	17x17'	17x17'	80' diam
Range (A)	1700-6000	1700-6000	1350-2750
Aeff(2700A)	20cm ²	30cm ²	60cm ²



* Excluding solar blind channel of ACS on HST

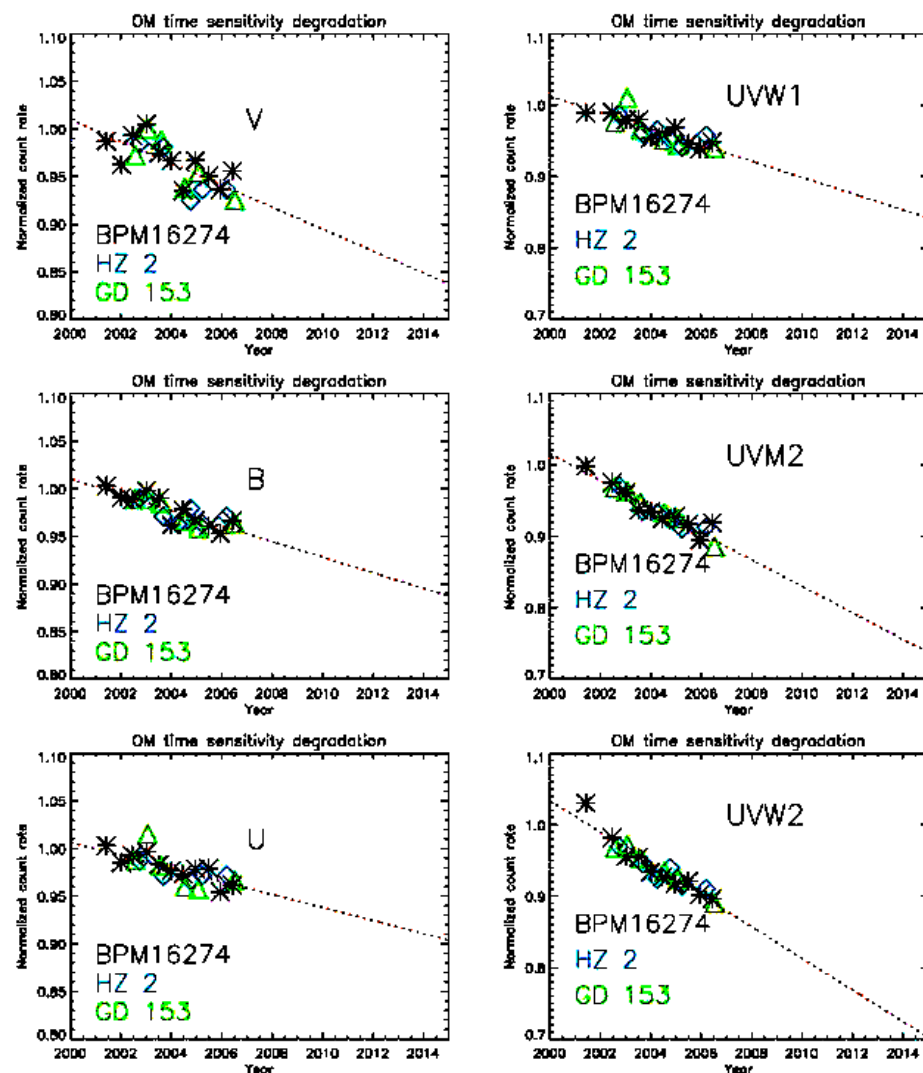
OM is under-exploited.

- Lets face it, not every X-ray astronomer knows how to deal with optical/UV images.
- So we're going to make it easier.
- By making a catalogue of sources from the OM.
 - First catalogue will have $\sim 10^6$ unique UV sources.
 - Reliable, multi-band photometry (fully matched) for point and extended sources.
 - Flagging of great majority of artifacts (e.g. smoke rings from bright stars, scattered light features).
 - High quality catalogue, so you can really use it for science.

OM in the next 10 years

- The filter wheel mechanism is a critical system as it has moving parts and a limited life.
 - At the current rate of filter wheel rotation it should reach its specification in about 17 years time.
- There is some redundancy in the electronics.
 - For example, there are more temperature sensors than absolutely necessary.
- OM also has a **complete** system (filter wheel, electronics, detector) held in cold redundancy
 - The change is made by rotating a 45° beam steering mirror under stepper motor control to direct the light through a separate filter wheel to a separate detector.
 - Only the primary and secondary mirrors and beam steerer are common.
- **OM was built to last, just like XMM-Newton.**

Evolution of the instrument sensitivity



- As a result of accumulated radiation, the MCPs show a slow decline in gain.
- This translates to a slow decline in sensitivity of the XMM-OM, by 1-2% per year.
- This is well calibrated, and dealt with by the analysis software.

New XMM Survey mode - could OM be used?

- XMM-OM is a remarkable instrument
- The MIC detector is a photon-counting device.
 - Recall that images are corrected for spacecraft drift in memory as they are being accumulated.
 - XMM-OM **CAN** in principle take data while spacecraft is in motion.
 - Readout is fast enough to accommodate 30deg/hr slews without degradation of PSF.
 - A real-time raw-data (RTRD) mode was developed for this purpose by the US side of the XMM-OM team.
 - It will return an event list just like EPIC cameras do, so that images can be reconstructed on the ground.
- Could be possible to do contiguous, joint X-ray and UV surveys in this mode.
- In this mode, the limiting factor is actually **not** the size of the telescope but the allowed telemetry rate.

New XMM Survey mode - could OM be used?

- The mode was developed by the US part of the OM team early in the mission
 - But abandoned because XMM-Newton was not carrying out any slew surveys!
- It hasn't been fully tested or commissioned.
- We are currently assessing level of work to realise this mode.
- For EPIC survey with mean exposure 500s, could feasibly get to 17mag in UVW2.
- Could be some nice science -
 - Simultaneous UV (e.g. 2000A) coverage of large, shallow X-ray survey.
 - Low-z AGN SEDs.
 - Simultaneous X-ray/UV accretion events in AGN.
 - UV/X-ray flares in Galactic stars.
 - UV images of all X-ray selected star forming galaxies in the survey.
- Implementation probably depends on tradeoff between potential science (including amount of time XMM-Newton would be doing slew survey!) and manpower at the SOC.

- A lot of people here already know how to get good science from OM with UV imaging fast photometry, or whatever.
- But I know that there are some people in the audience that have no idea what to do with XMM-OM. (Extragalactic survey folks are especially bad).
 - Its not very big compared to Subaru or VLT.
 - Its **UV** imaging capabilities significantly better though!
- XMM-OM's sweet spot is 2700Å UVW1 filter*.
- Throughput is good in this band (not true at shorter wavelengths).
- Degrading by only 1% per year at this wavelength.
- Long exposures in full-frame low-resolution (1") mode are very efficient.**
- Overlapping X-ray pointings will give simultaneous, contiguous tiled survey of the sky in the UV.

* That's about 0.006 keV for really hardcore X-ray astronomers.

** Follow this advice, and you will get factor~2 more UVW1 photons than original XMM-OM pre-launch prediction!

- OM is a unique resource of XMM-Newton.
- It is being used for a wide variety of applications.
- Nonetheless, it could be exploited more.
 - High quality catalogue is on the way.
- Over the next 10 years we anticipate only a very small degradation.
- If the slow slew survey had significant usage, OM might be able to make a simultaneous UV survey.
- For extragalactic surveys, UVW1 full-frame imaging is a good way to go.