X-RAYS FROM STAR FORMING GALAXIES

Elena Terlevich
Daniel Rosa González
Roberto Terlevich
A.Comastri
P.Nandra

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INAOE +

Motivation

- To study the relation between SFR and L(X).
- By hard X-rays vs. optical, FIR and radio, to confirm and calibrate the apparent empirical relation (obtained for massive galaxies and contaminated by LMXB; also, previous low spatial resolution observations so could be contaminated by AGN).
- High SFR, low mass galaxies =>
  Hard X-rays dominated by SFR-tracing HMXB.

- Chandra and XMM allow X-rays tracers to high z (Nandra et al 2002) but need good calibration.

Goals

- To study relation L(X)-SFR given by e.g.L(Halpha) in a homogeneous sample of SF galaxies.
- To compare SFR obtained with other tracers (e.g.UV, FIR, Radio).
- Calibrate a reliable L(X) – SFR that can be used with other X-ray observations.
- Obtain an independent UV based SFR from the UV OM instrument.
- By-pass attenuation corrections by studying Hard (2-10KeV) X-rays.
- X-rays in SF galaxies come from HMXB, O stars, young SNR, hot plasma (massive, short lived stars which directly trace present SF).

XMM-Project

To observe with EPIC in soft and hard X-rays, HII Galaxies that have large (optical) SFR and expected strong L(X).

7.5 < SFR < 335.4 (Solar masses/a)

All have optical, FIR (and some 1.4GHz VLA) data.

Mrk 52 , Cam0902+1448a, Tol1247-232
Mrk 605, Tol2259-398
UM530,
Tol2306-400, Tol0420-414, Haro0040.8-00,
Tol0619-392,

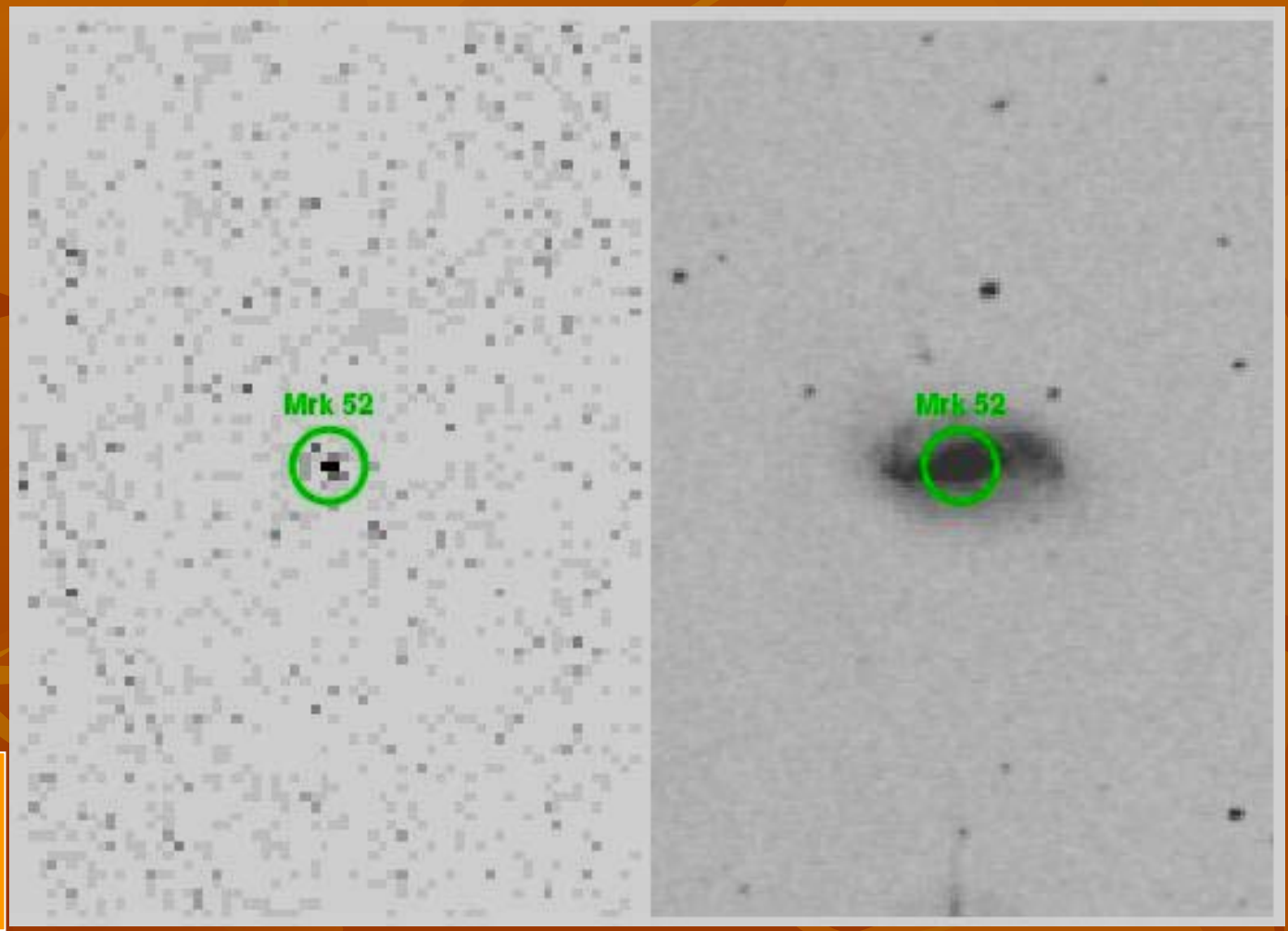
Tol0145-391, Tol1457-262A, Cam08-82A,
Cam1403+0931, UM421, UM444

- We used empirical relations for 2-10 keV (Grimm et al. 2003) and for 0.5-2 keV (Ranalli et al. 2003) and calculated that we needed~5ks per object.
- Hard X-rays suffer from less uncertainties as SFR tracers.

XMM-Project

We also observed simultaneously 2 UV wavelengths (2600 and 2000 Å) with the UV-OM instrument in order to determine SFR independent ly and also extinction.

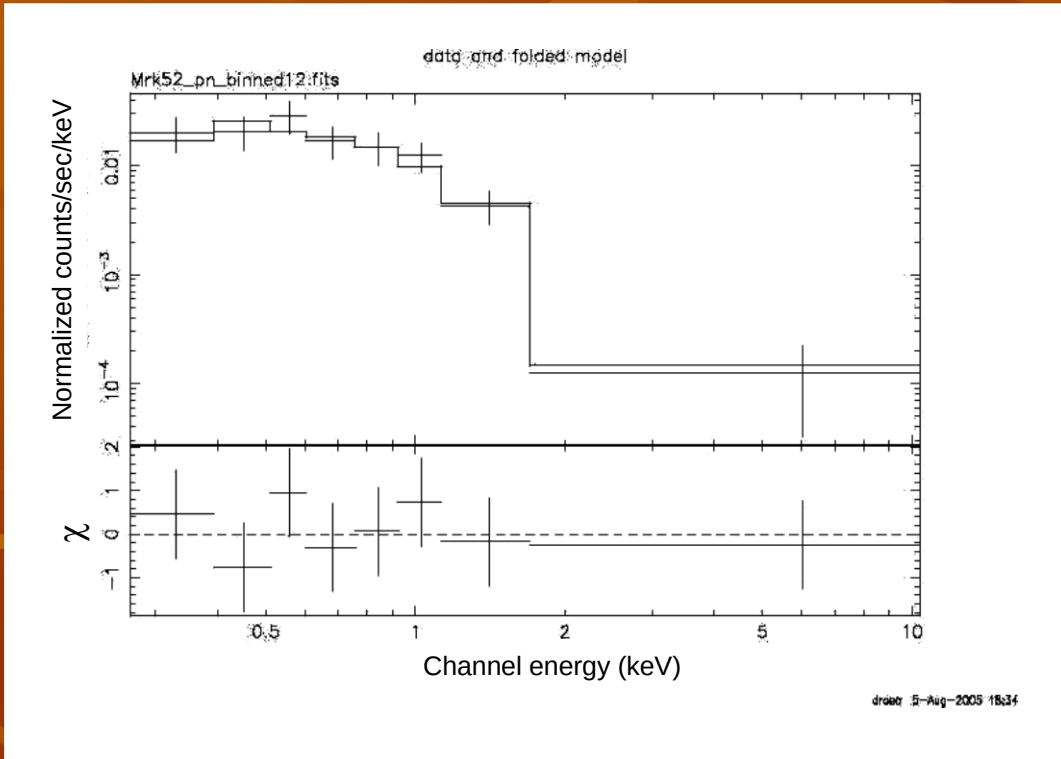
Mrk 52



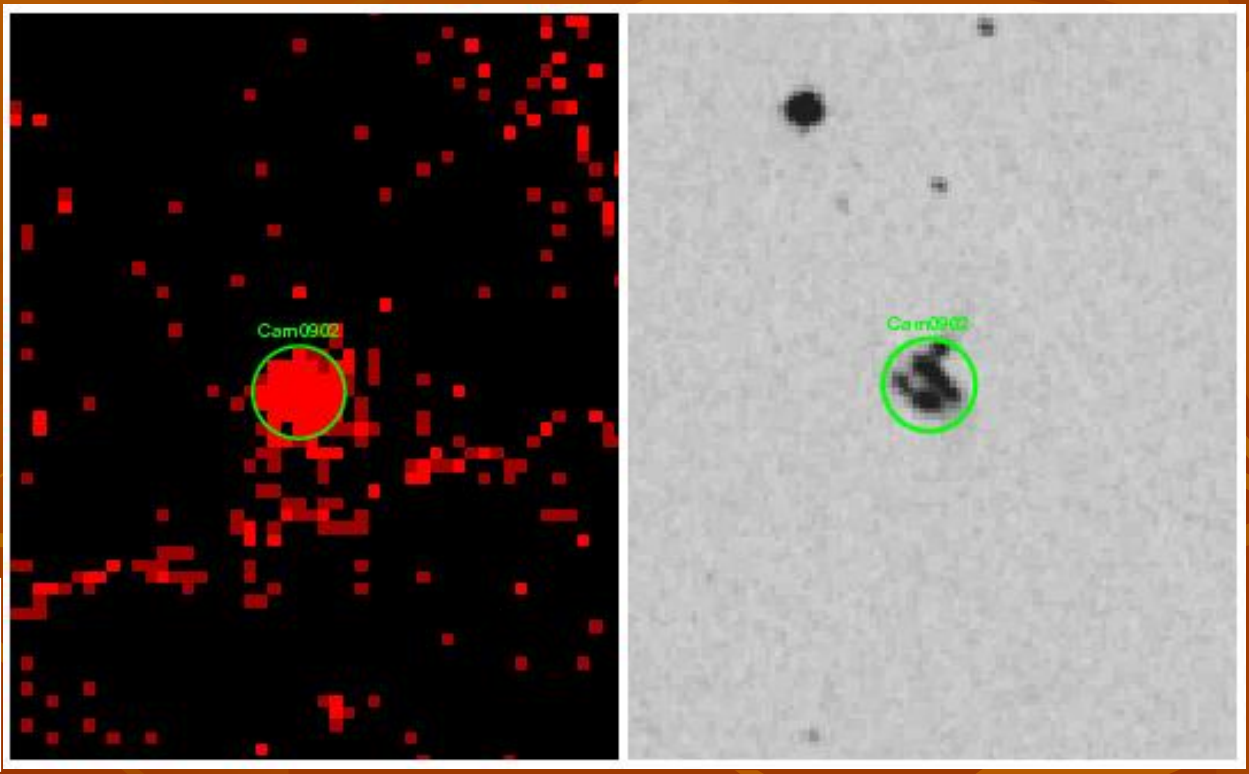
X-rays

optical

Mrk 52 spectrum
(power law + absorption)



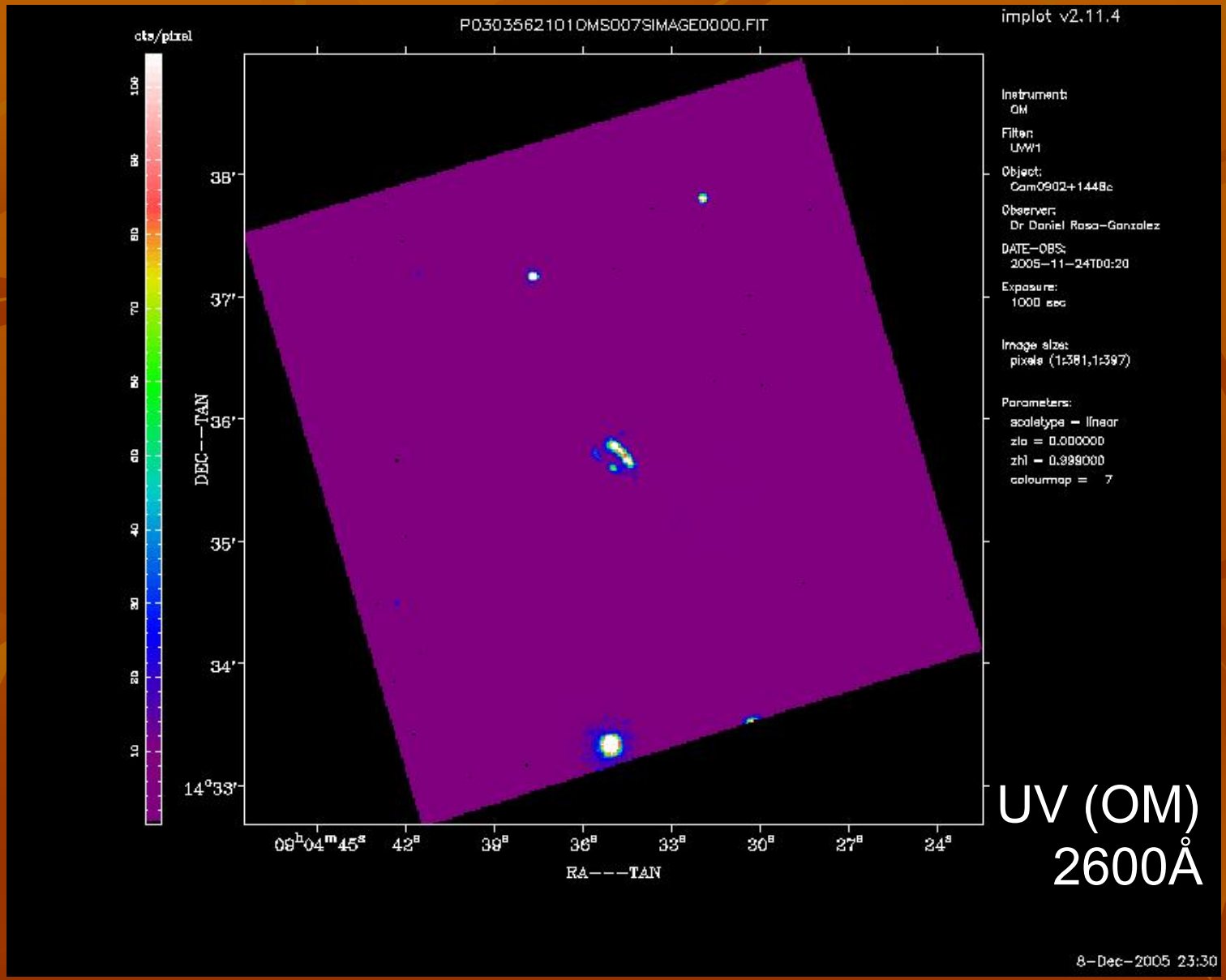
Cam 0902



X-rays

optical

Cam 0902



UV (OM)
2600Å

XMM-Project

To date, 10 galaxies from our list have been observed and we have:

3 spectra
2 undetected (even though low background)
1 unseen (very high background)
4 unseen (high background)

6 observations still to come.

Concluding remarks

These results are puzzling!

Still to check collapsed spectra (RGS).

Apply again,
with longer exposures