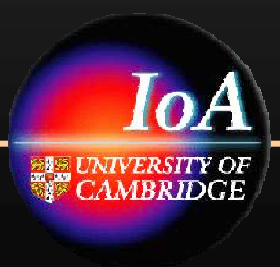
IRAS 13197-1627:
a composite AGN-starburst galaxy (I)

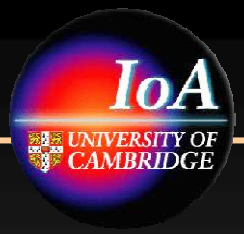
Giovanni Miniutti
Institute of Astronomy - U. of Cambridge

in collaboration with
G. Ponti, M. Dadina, M. Cappi & G. Malaguti (INAF/IASF + U. di Bologna)



May 2006 - AGN 7 @ Montagnana

GM et al 2006 MNRAS submitted



IRAS 13197-1627 with XMM-Newton

IRAS 13197-1627 is a nearby (z=0.16) Luminous IR galaxy

with L_{IR} (80-1000μm) = 1.7 x 10^{11} L_{Sun} = 6.7 x 10^{44} erg s^{-1}

It was initially classified as a Seyfert 2 but later became Seyfert 1.8

Radio is moderately extended with $L_{1.4GHz}$ = 1.6 x 10^{30} erg s^{-1} Hz^{-1}

It was observed in X-rays by ASCA in 95 (Ueno 97)
SAX in 98 (Risaliti 02; Dadina & Cappi 05)

ASCA: $\Gamma \sim 3.0$ and $N_H \sim 7 \times 10^{23}$ cm^{-2}
SAX: $\Gamma \sim 2.5$ and $N_H \sim 4 \times 10^{23}$ cm^{-2}

+ the SAX spectrum is complex (PC or RD) and implies $L_{2-10} \geq 10^{44}$ erg s^{-1}

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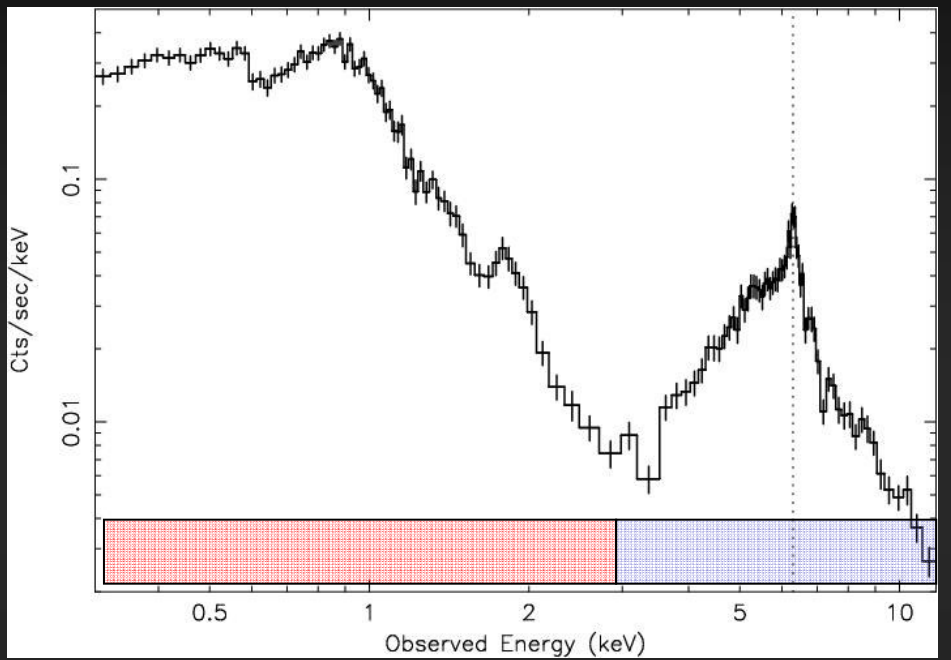
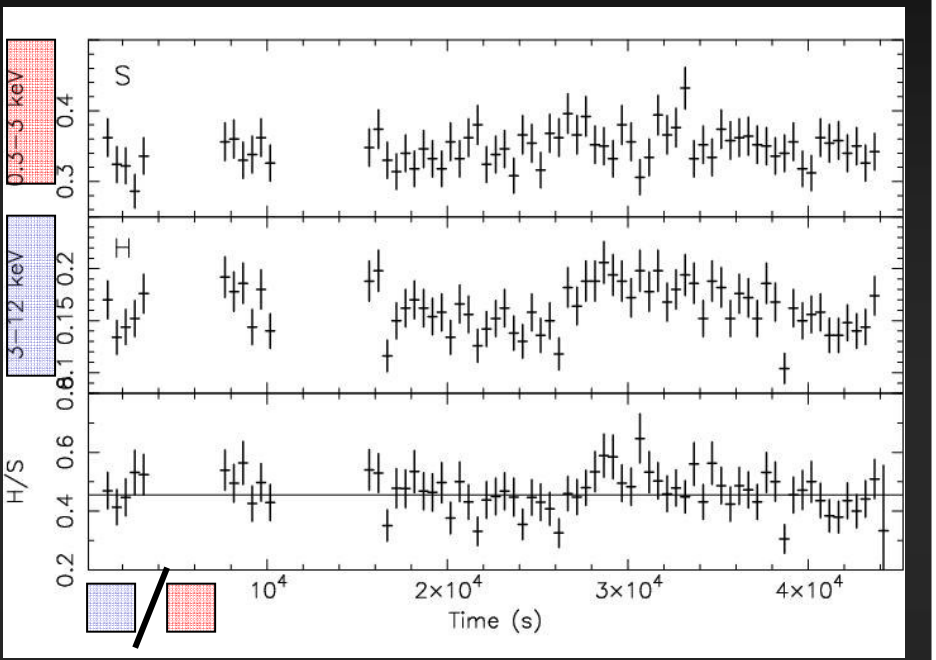
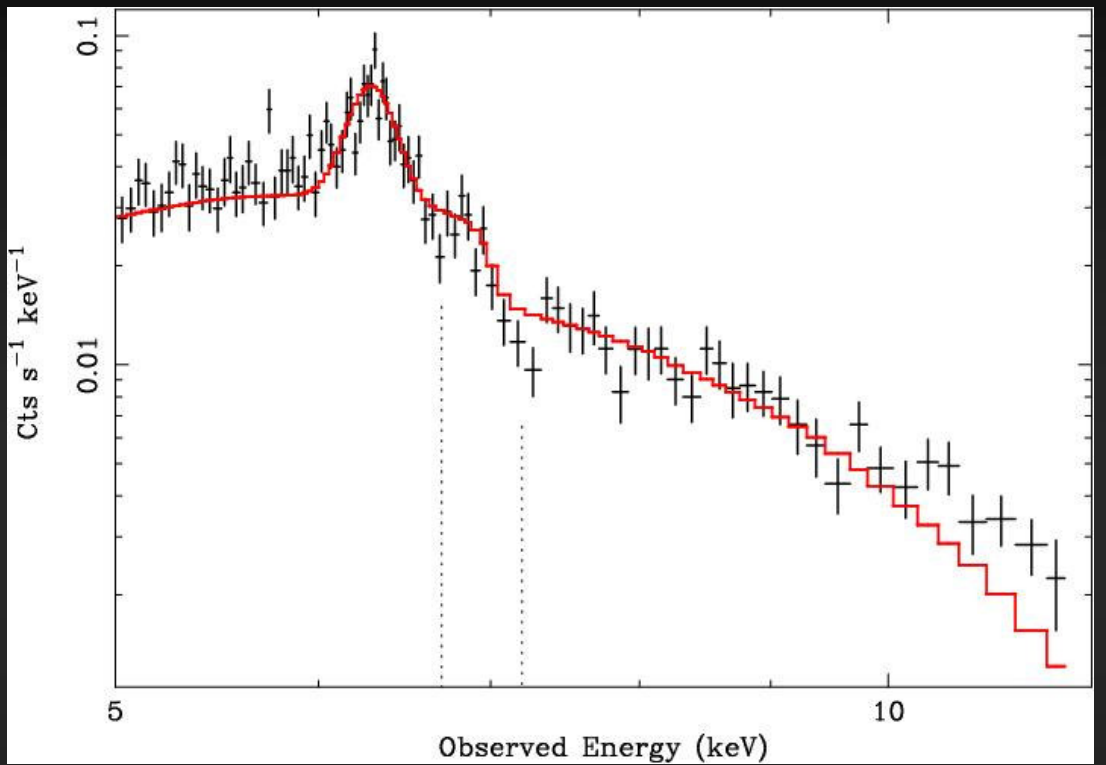




First look: absorbed AGN (Fe edge and Fe K line plus low-E cutoff)
structured ``soft excess'' below 2-3 keV

Variability: soft is consistent with no variability
hard is (slightly) more variable

IRAS 13197-1627 with XMM-Newton



2-12 keV band: an absorbed Compton-thin (4 x 10^{23} cm^{-2}) AGN, but

- Fe K is resolved (σ ~ 100 eV)
- transmitted Fe K EW and Fe edge suggest Fe is 1.5-2 x Solar
- 6.8 keV absorption line (rest-frame)
- Positive residuals > 10 keV and in 5-6 keV band

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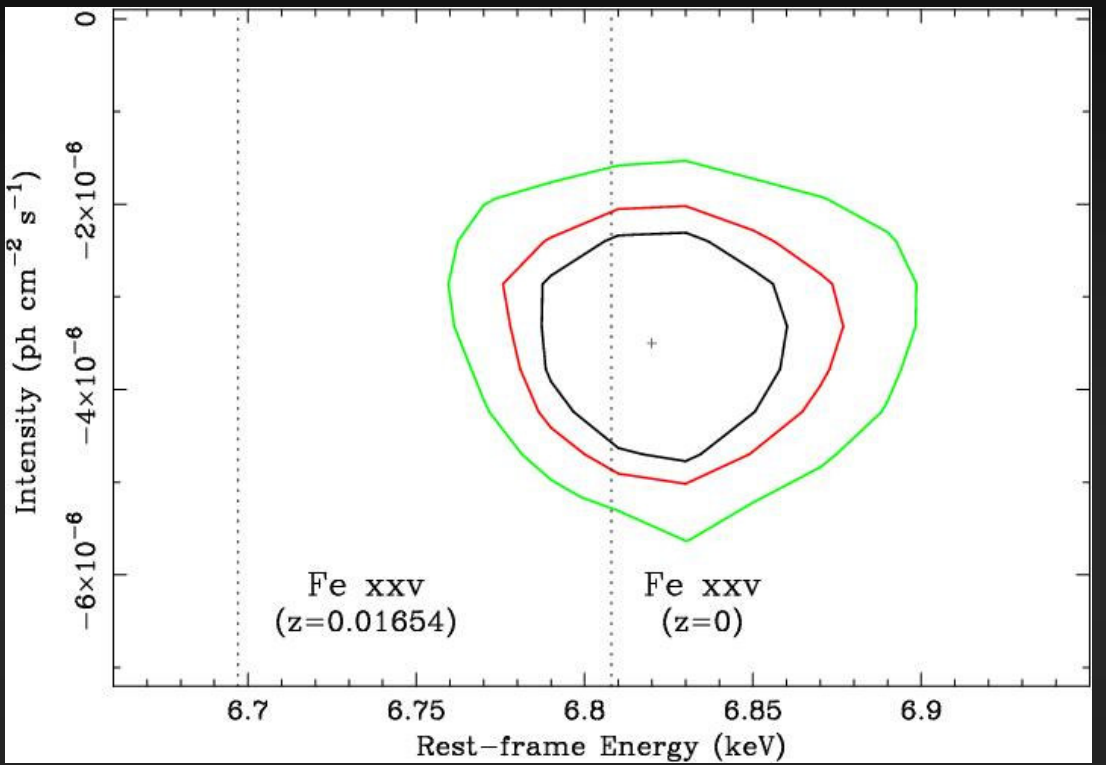


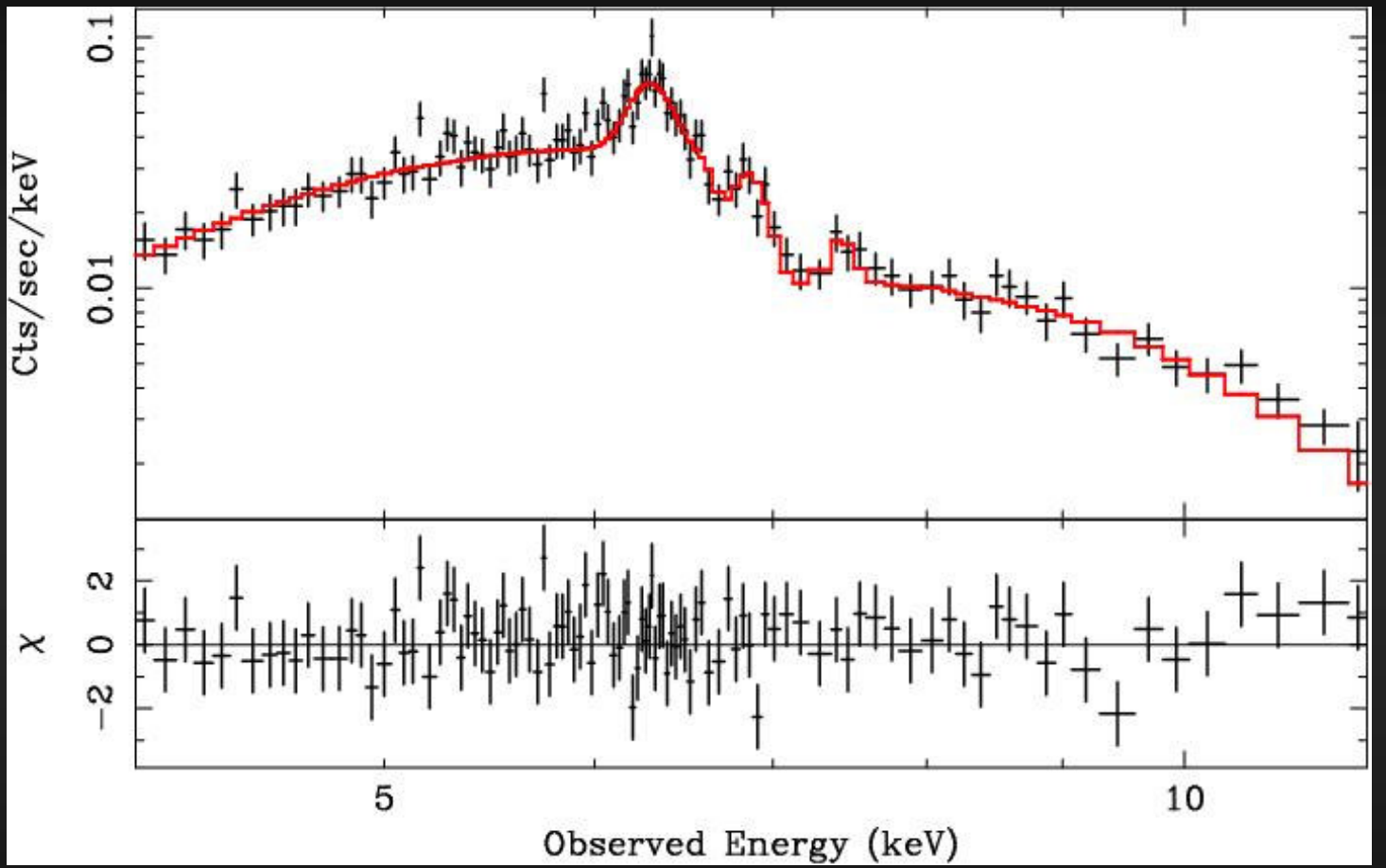
the 6.8 keV absorption is significant and confirmed in the MOS data

most likely Fe xxv resonant absorption (6.697 keV) blue-shifted by 5000 km/s with a Fe xxv column of 10^{19} cm^{-2}

Outflow? Maybe … but notice that zc = 4959 km/s … (local hot bubbles?)

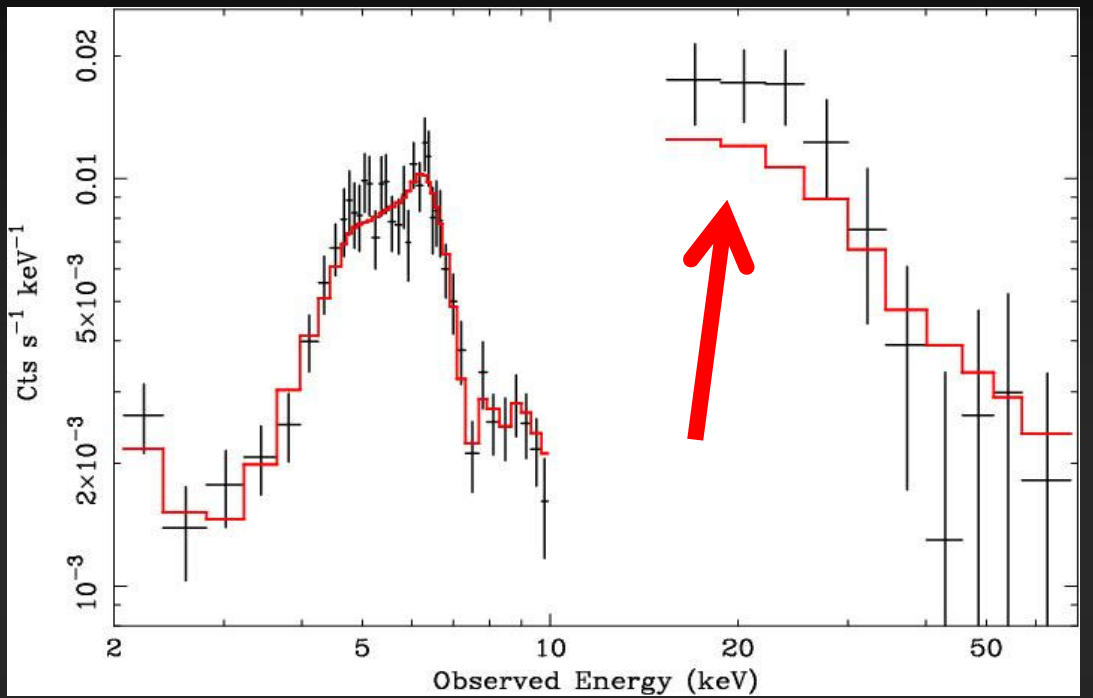
see McKernan et al 05

IRAS 13197-1627 with XMM-Newton



the final fit is very good but SAX does not like it very much …

IRAS 13197-1627 with XMM-Newton



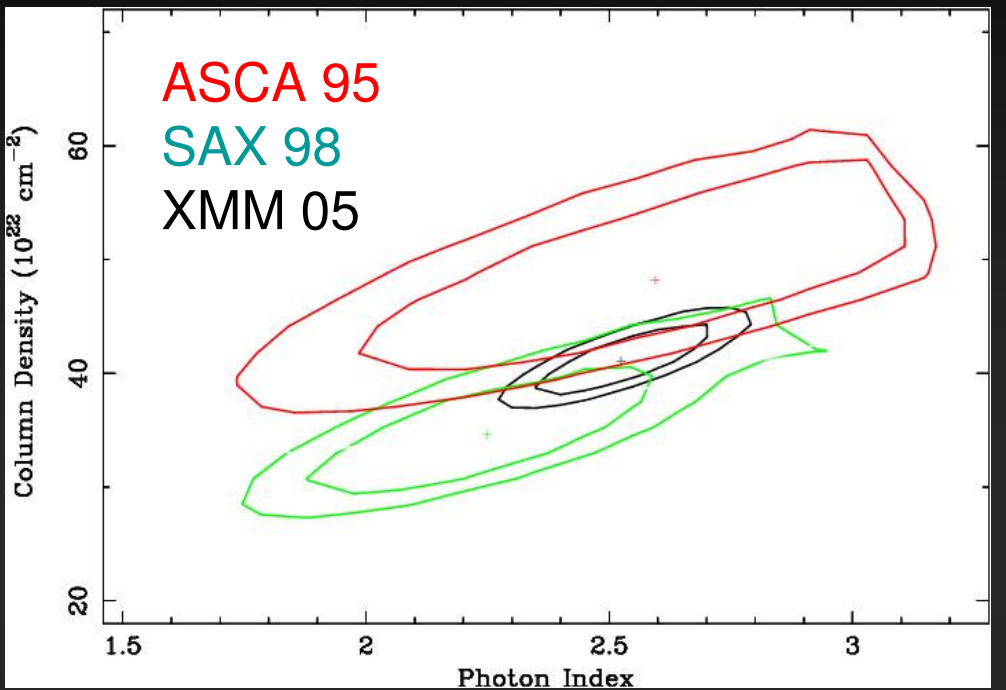
Dadina & Cappi 05

- a reflection component from the disc improves the stats (99% level)
- the hard spectrum is reflection-dominated (e.g. GM & Fabian 04 see Ponti's talk)
- the narrow component of the Fe K is now truly unresolved

$L_{2\text{-}10}$ (XMM)~ 4-5 x 10^{43} erg s $^{-1}$ and $L_{2\text{-}10}$ (SAX)~ 1-2 x 10^{44} erg s $^{-1}$

→ IRAS 13197-1627 is a local borderline type 2 Seyfert/QSO

IRAS 13197-1627 with XMM-Newton

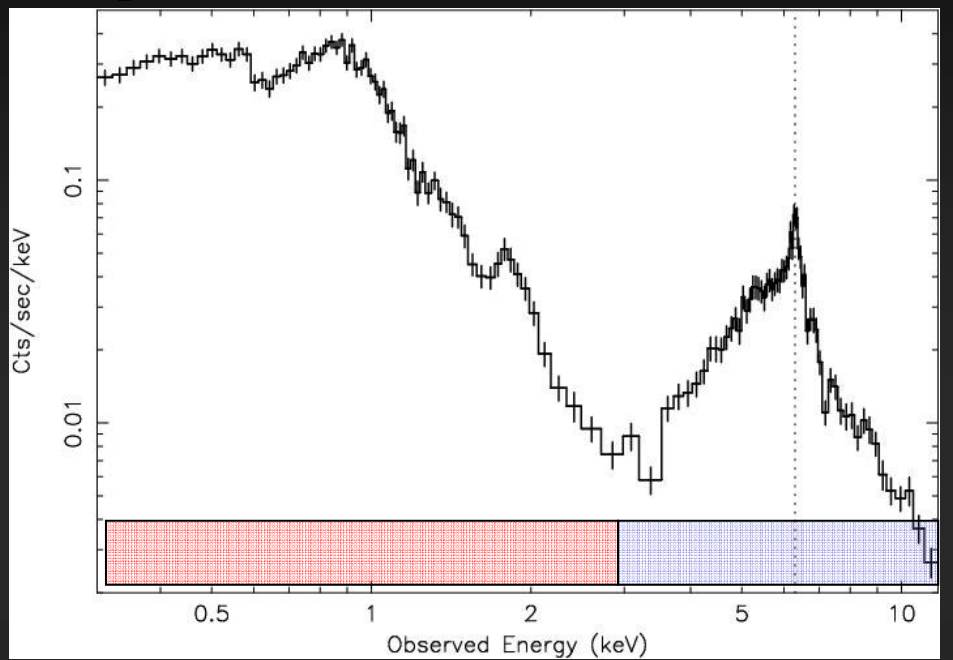


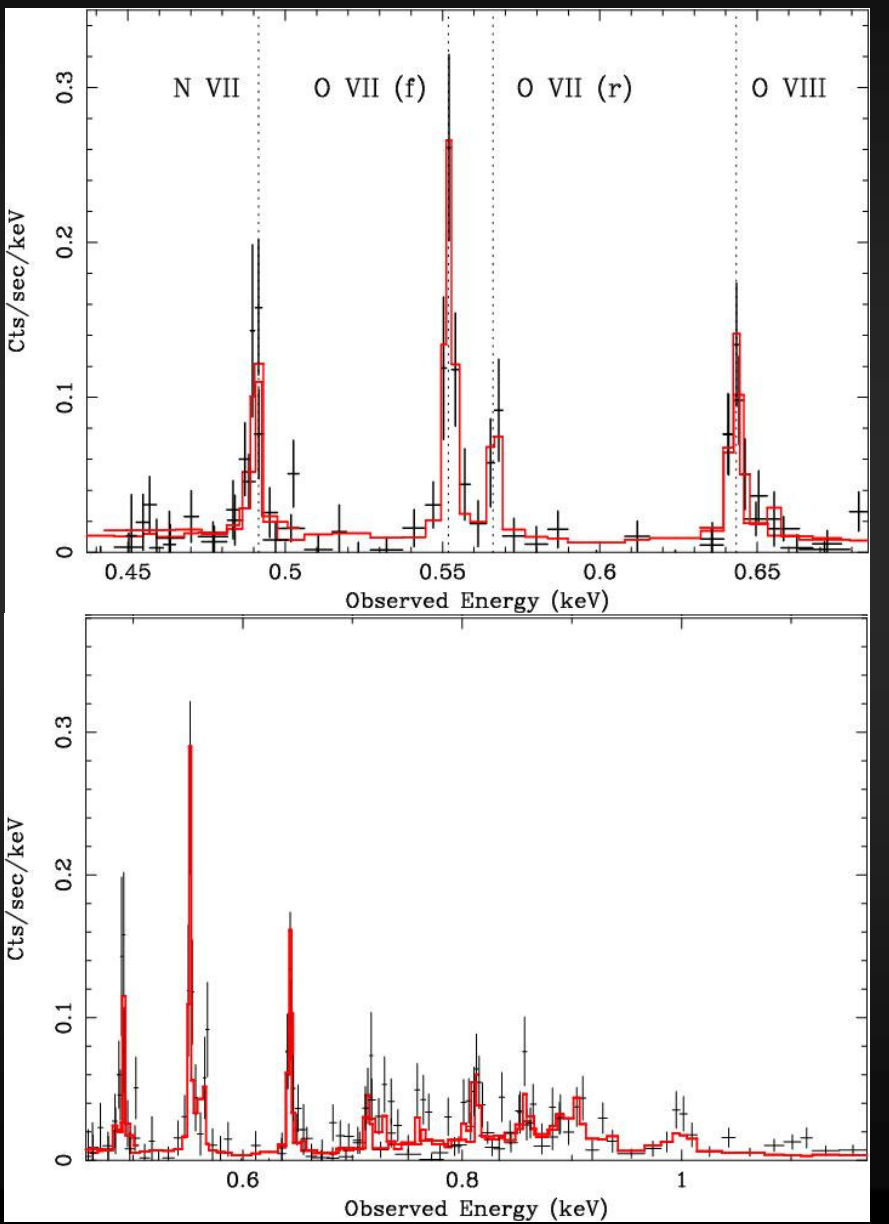
long-term variability is negligible

litterature data were used to infer N_H variability (Risaliti et al 03) but we do not confirm it

the absorber can be placed arbitrarily far away from the nucleus in agreement with the unresolved Fe K line in the final (RD) fit

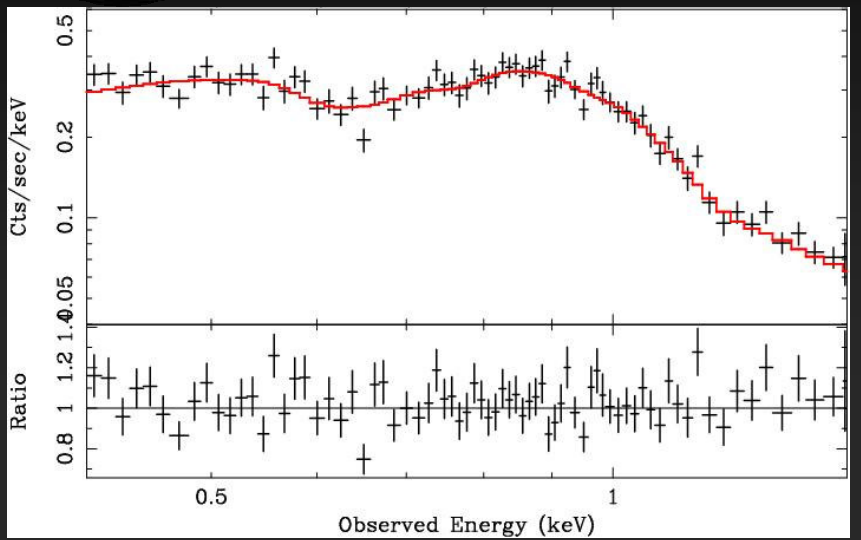
IRAS 13197-1627 with XMM-Newton

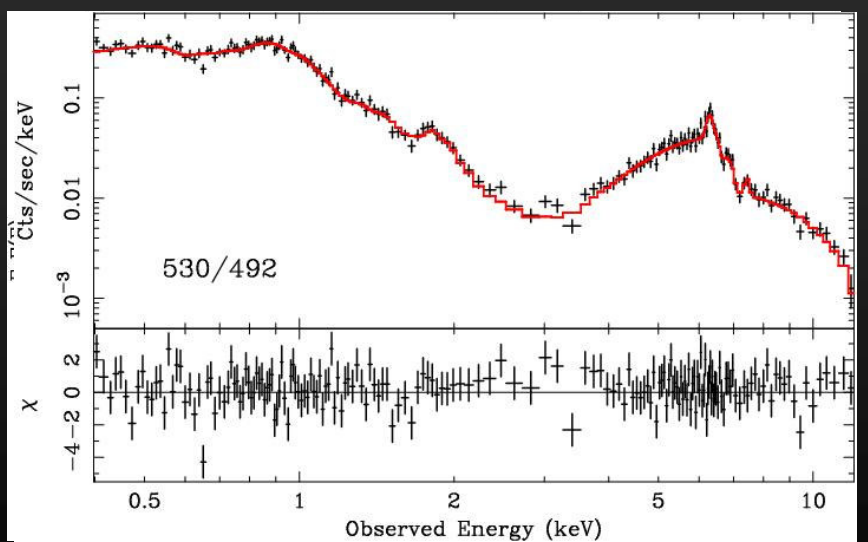




the soft band is dominated by emission lines from BOTH PHOTOIONIZED GAS and COLLISIONAL PLASMA

IRAS 13197-1627 with XMM-Newton





IRAS 13197 is a composite galaxy

the hard X-rays are dominated by a reflection-dominated luminous AGN (Seyfert/QSO borderline)

the soft X-rays are dominated by emission from AGN-ionized gas and by star-forming regions

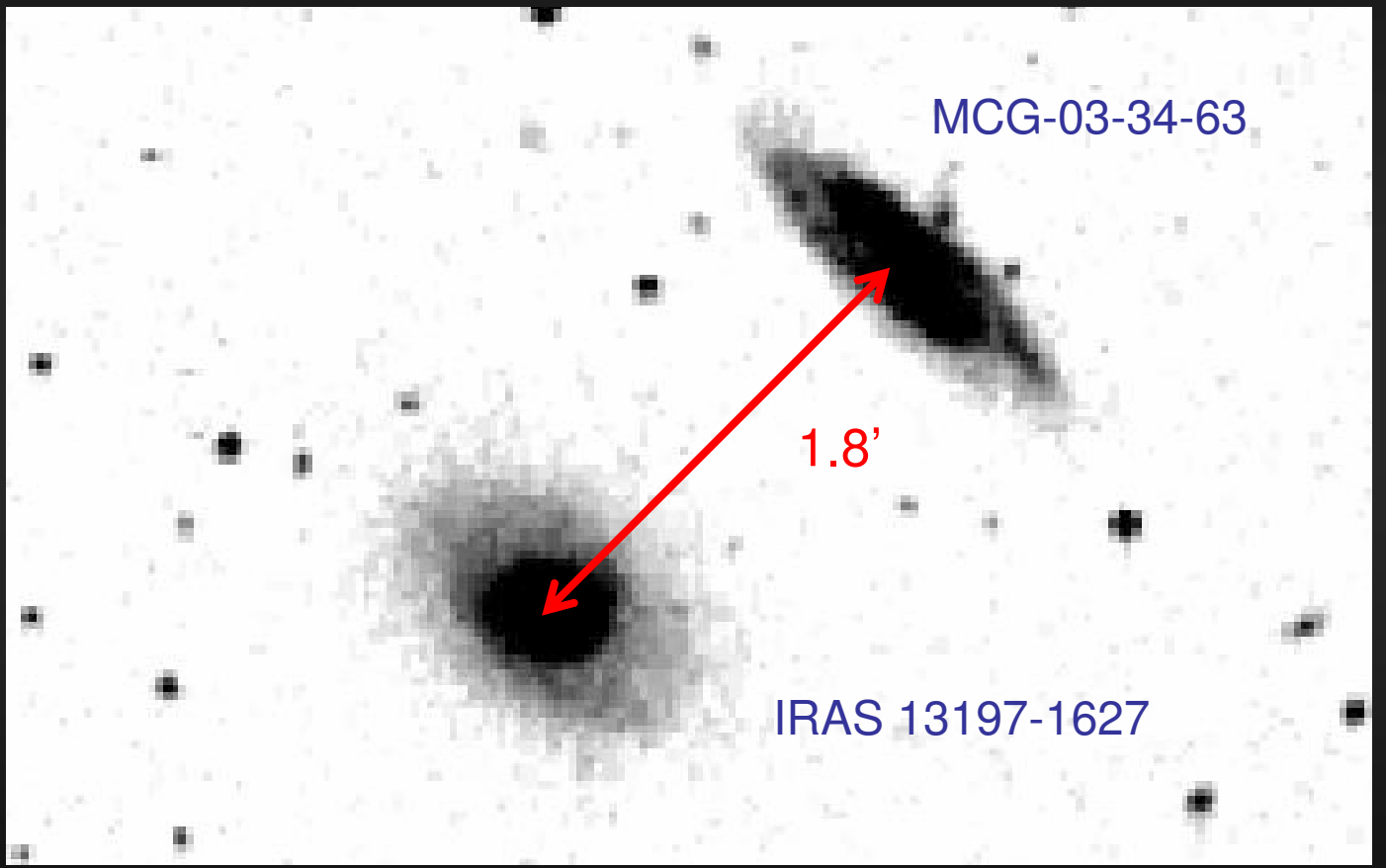
$SFR_X \sim 2.2 \times 10^{-40} L_{thermal} \sim 33\ M_{Sun}\ yr^{-1}$

$SFR_R \sim 2.5 \times 10^{-29} L_{1.4\ GHz} \sim 30\ M_{Sun}\ yr^{-1}$

$SFR_{IR} \sim 1.66 \times 10^{-44} L_{IR} \sim 37\ M_{Sun}\ yr^{-1}$

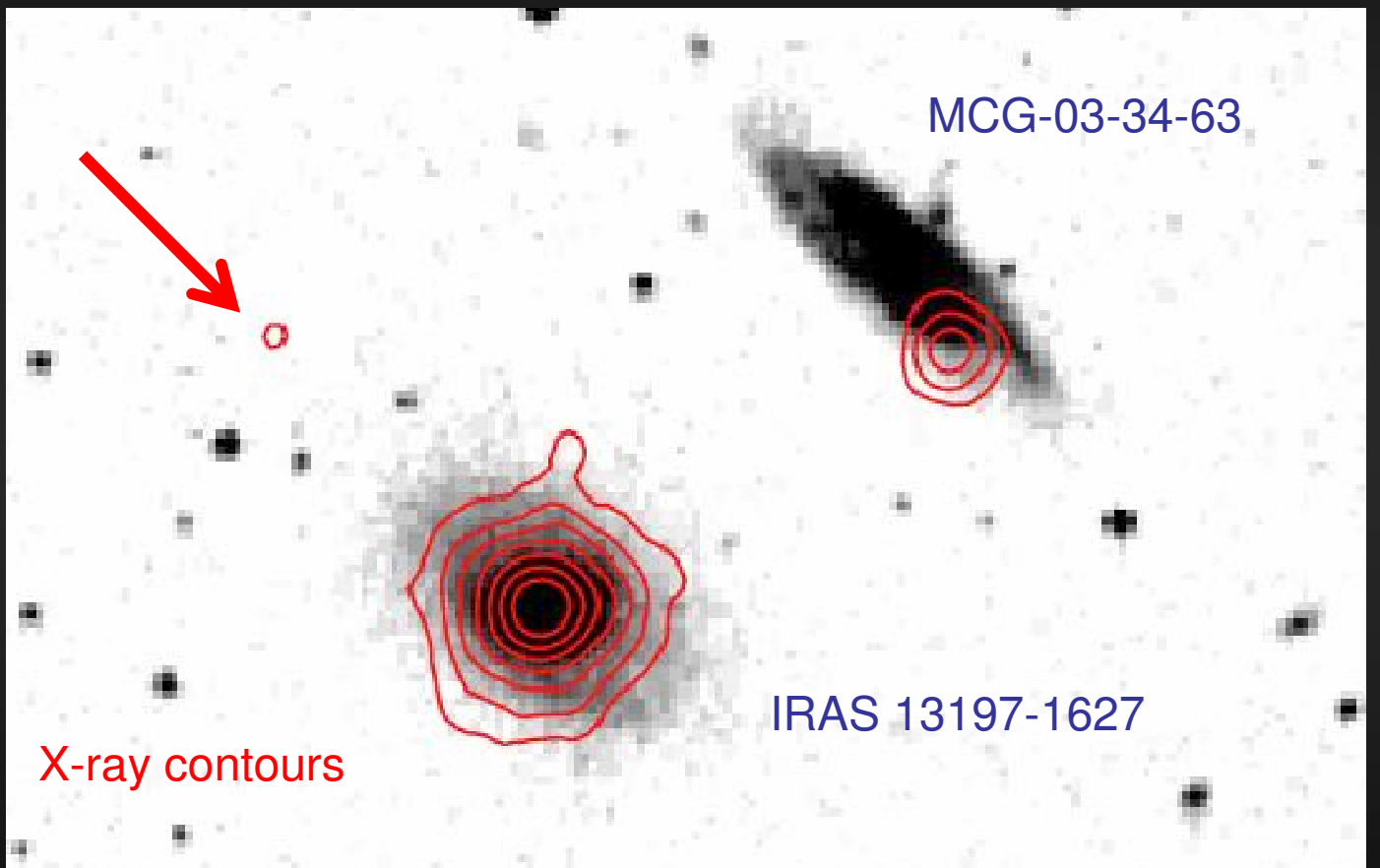
(Kennicut 98 and Ranalli et al 03)

MCG-03-34-63 ULX-1:
the most luminous ULX detected so far?

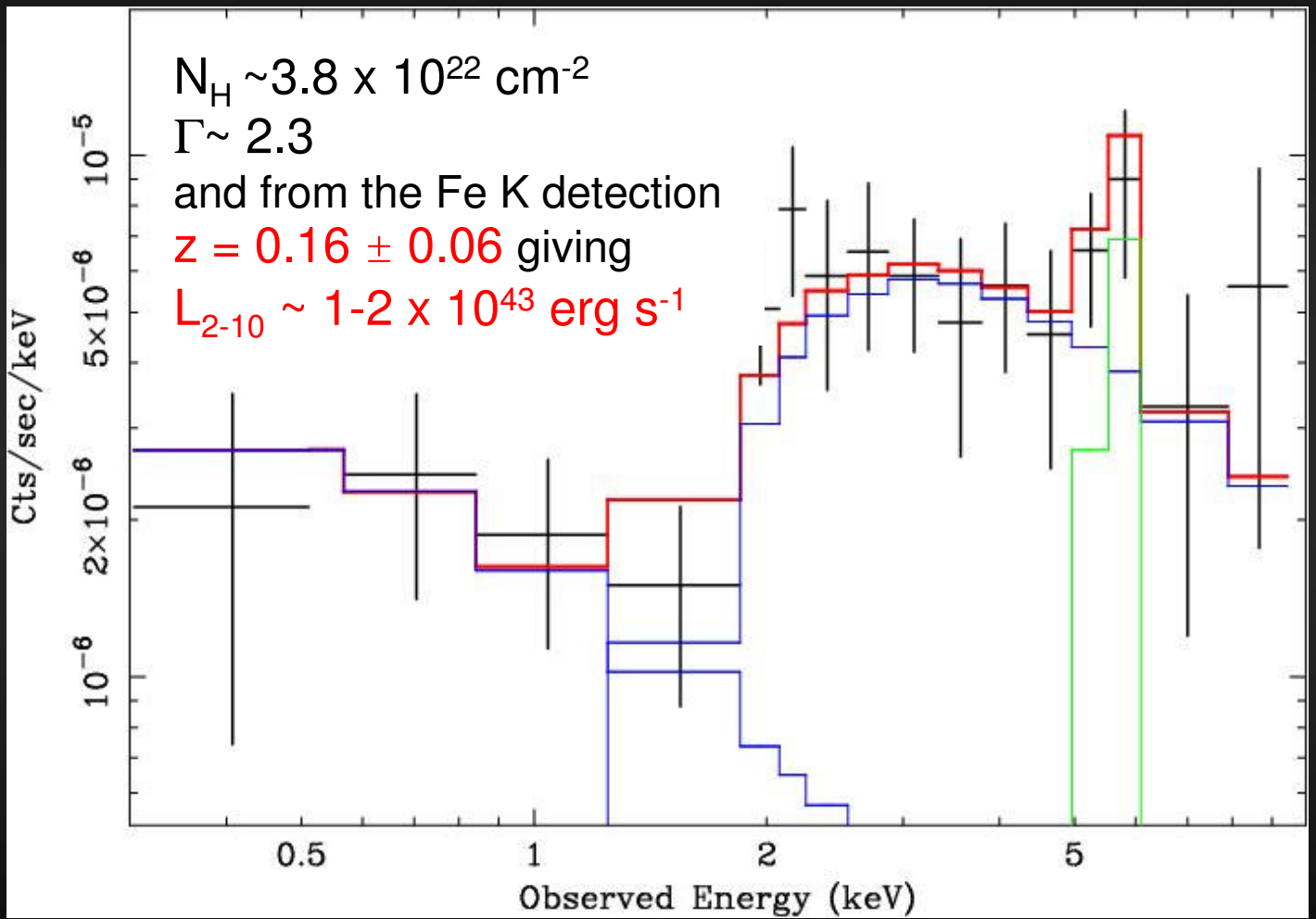


GM et al 2006 in prep

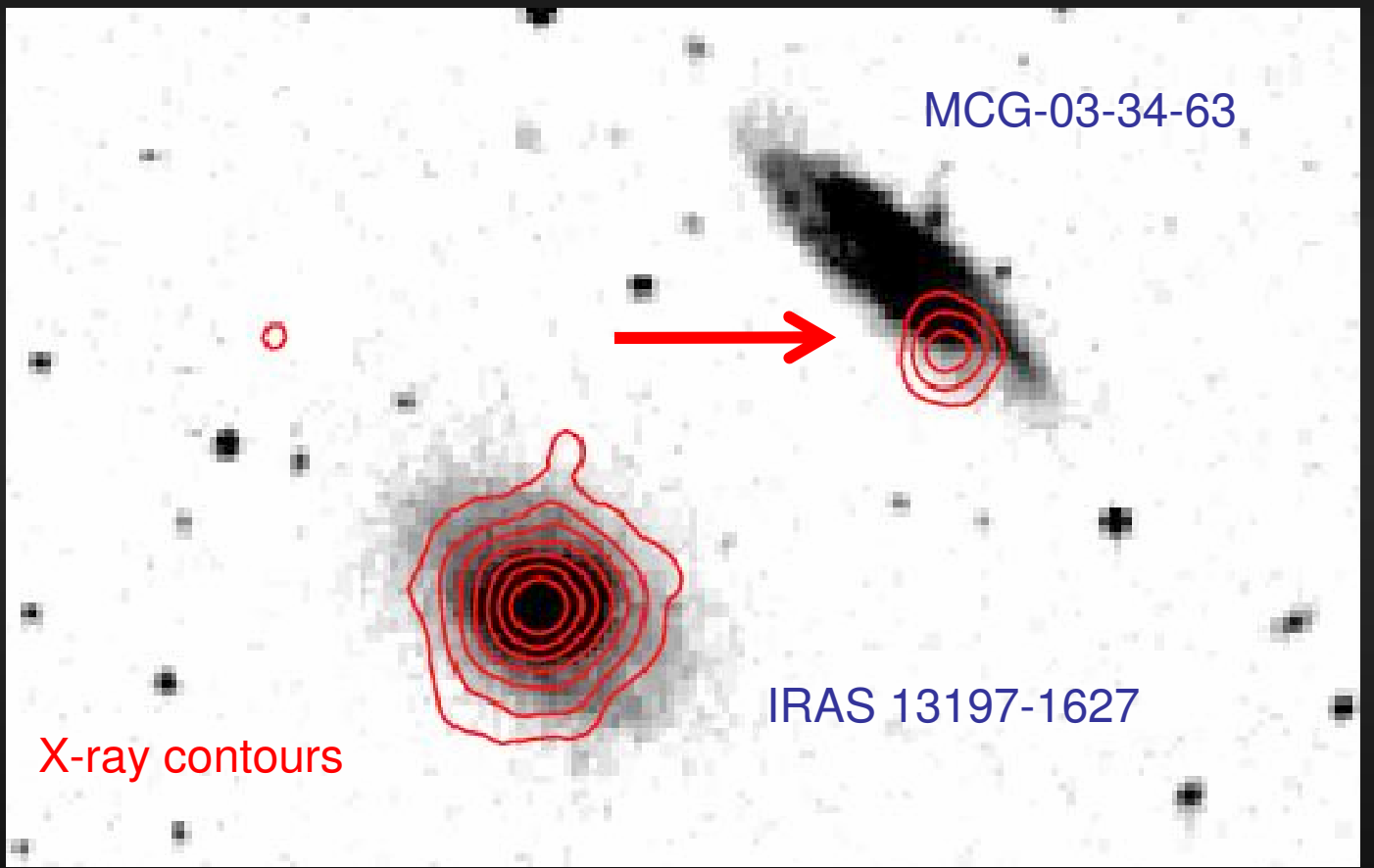
The central region



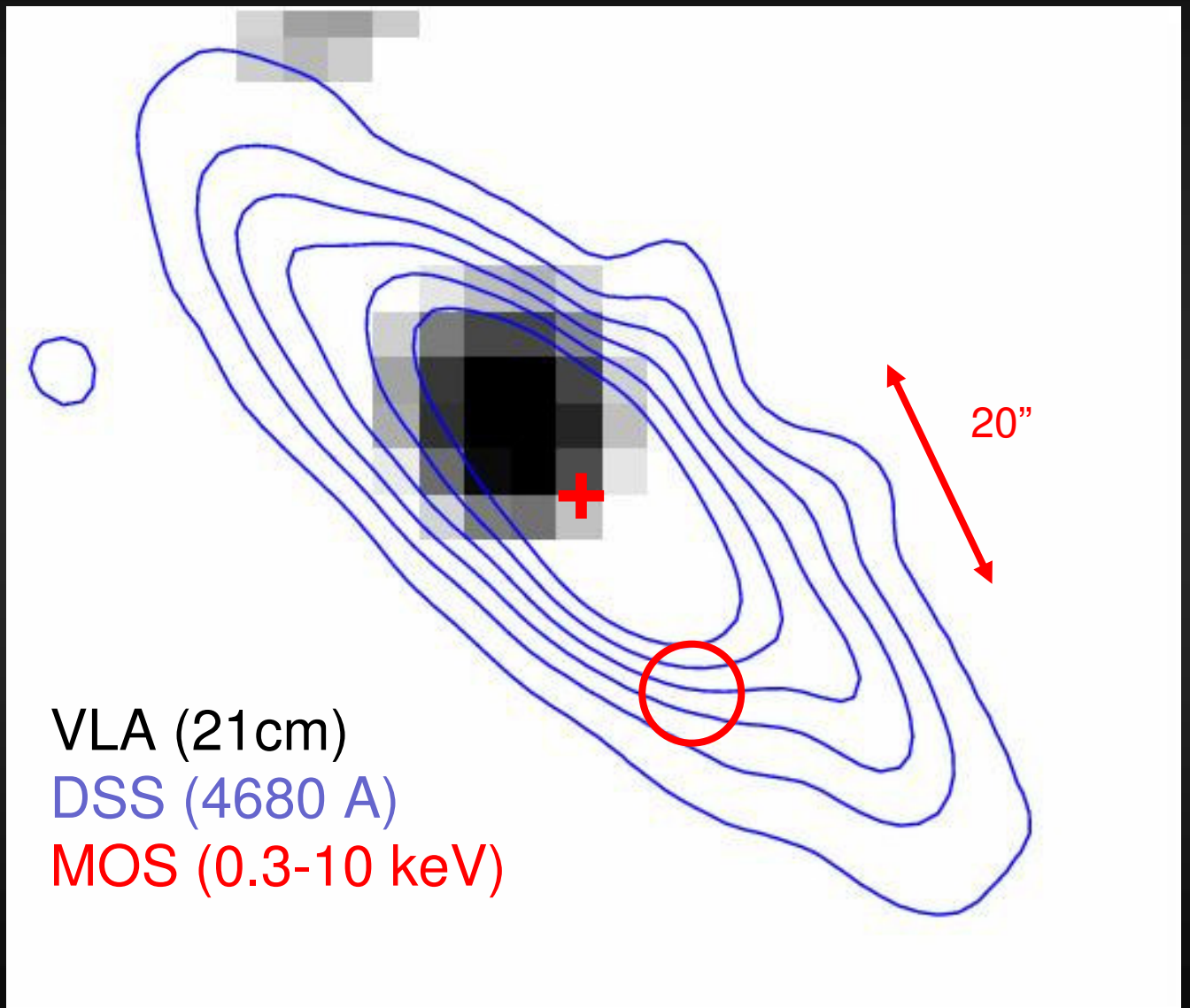
The central region



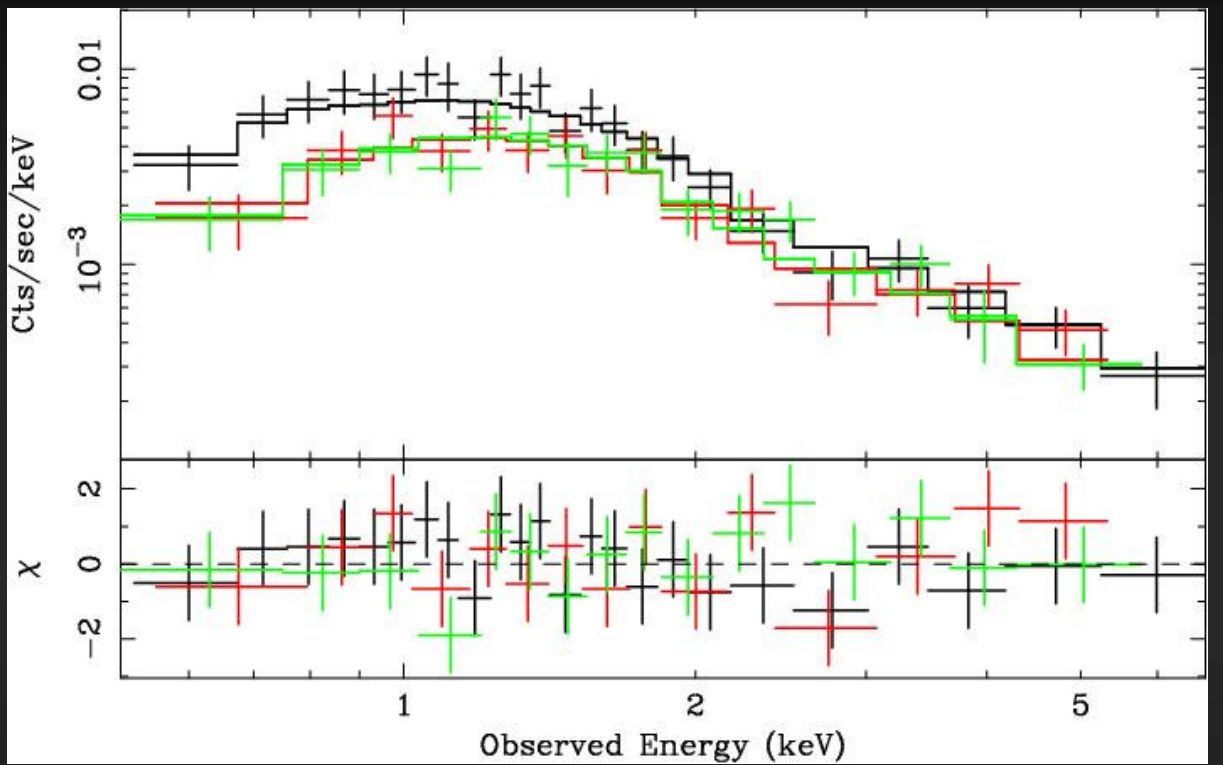
The central region



MCG-03-34-63: VLA+DSS +MOS



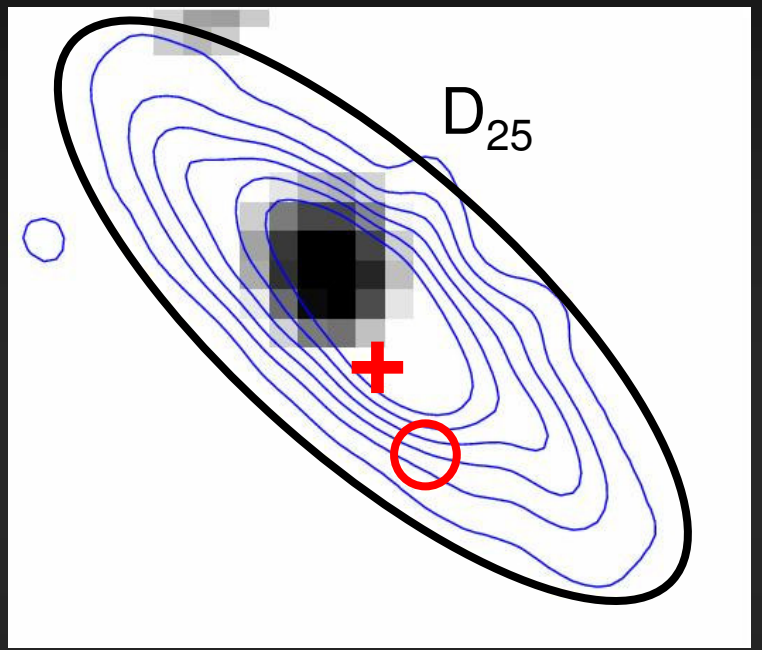
X-ray data analysis



an absorbed power law fit is good with $\Gamma = 1.9$

we measure excess absorption of 2.3×10^{21} cm^{-2} making it highly unlikely that we are looking at a foreground X-ray source

A background AGN or a ULX?



By assuming the observed logN-logS (e.g. COSMOS, Brusa's talk)

$N_{XRB} \sim 100 \times (S_{0.5\text{-}2}/10^{-14})^{-1/4} \times \text{Area}$

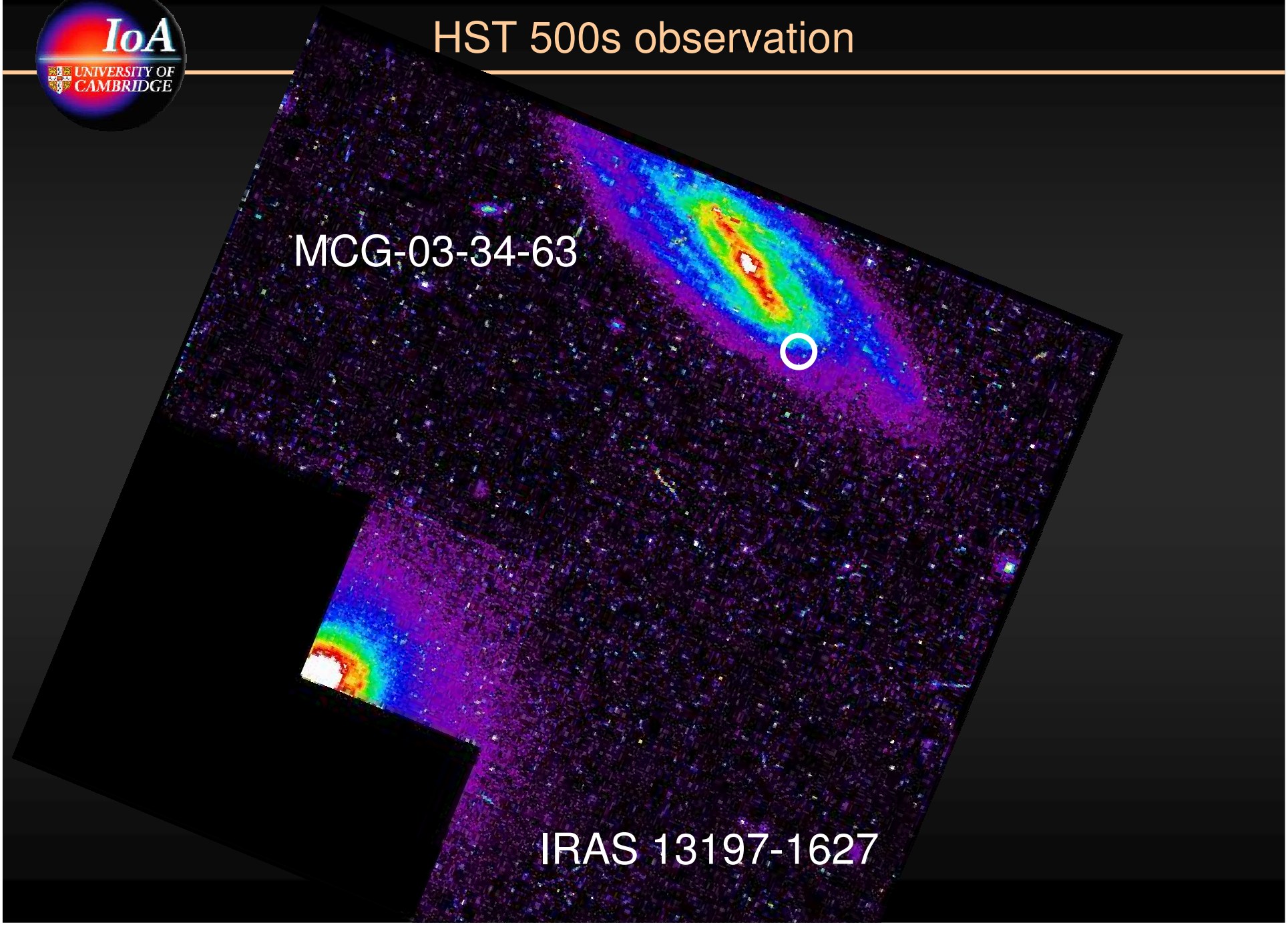
we expect < 0.02 sources in D_{25}

it is most likely within the galaxy at z = 0.021 and thus

$L_{2\text{-}10} \sim 7.4 \times 10^{40}$ erg s^{-1} or by extending the model $L_{0.2\text{-}100} \sim 2.3 \times 10^{41}$ erg s^{-1}

if taken at face value it would imply an IMBH with $M_{BH} \sim 1800\ M_{Sun}$!!

HST 500s observation



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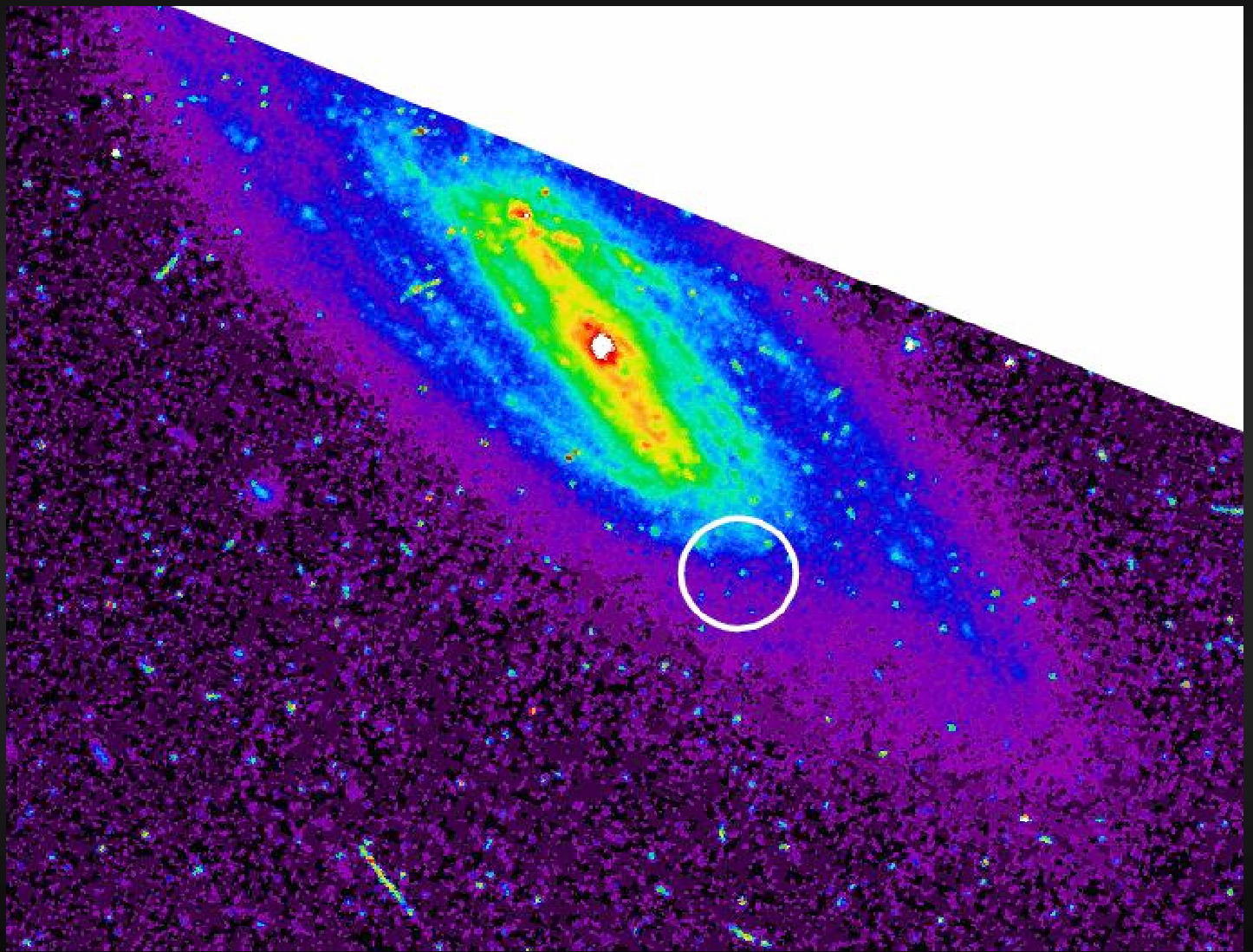
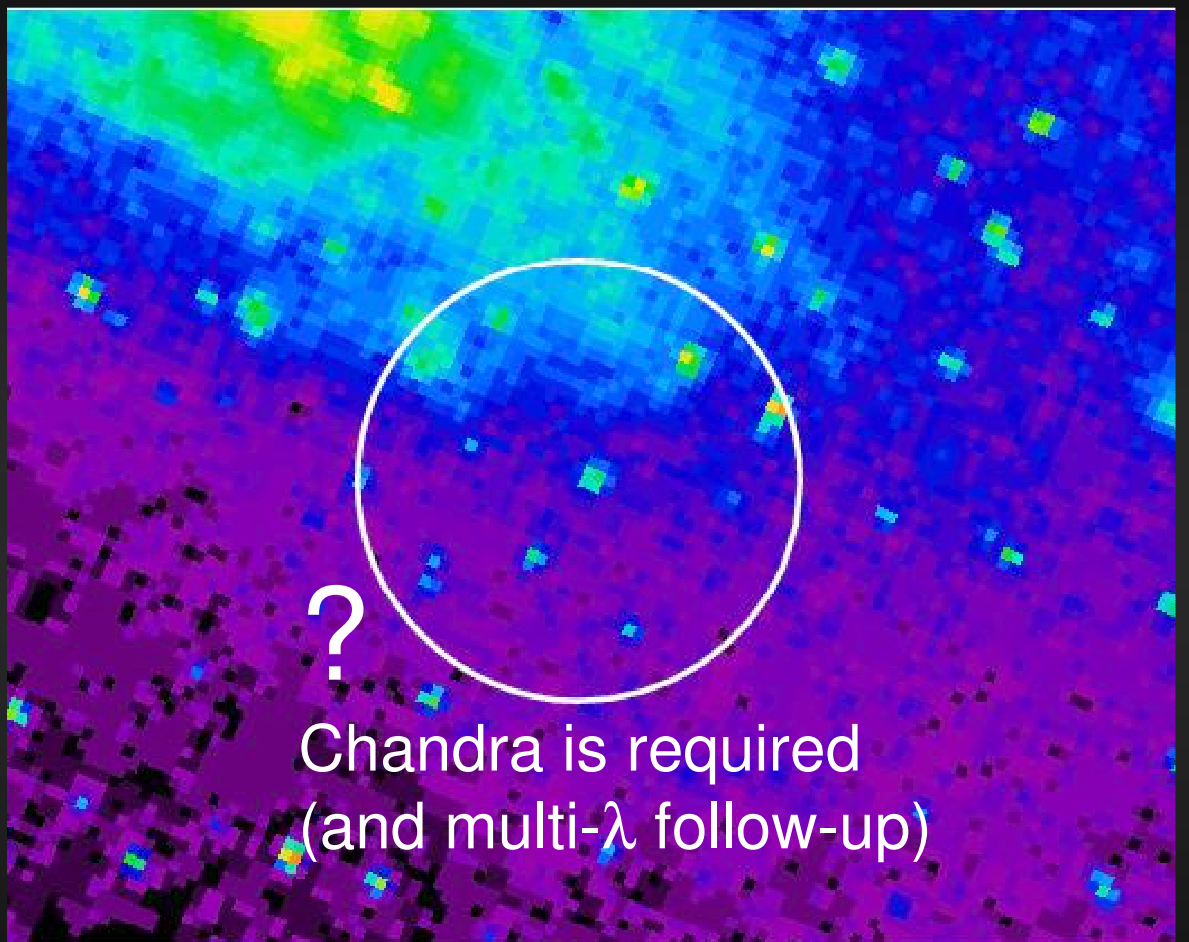


Possible Optical counterpart(s)



grazie