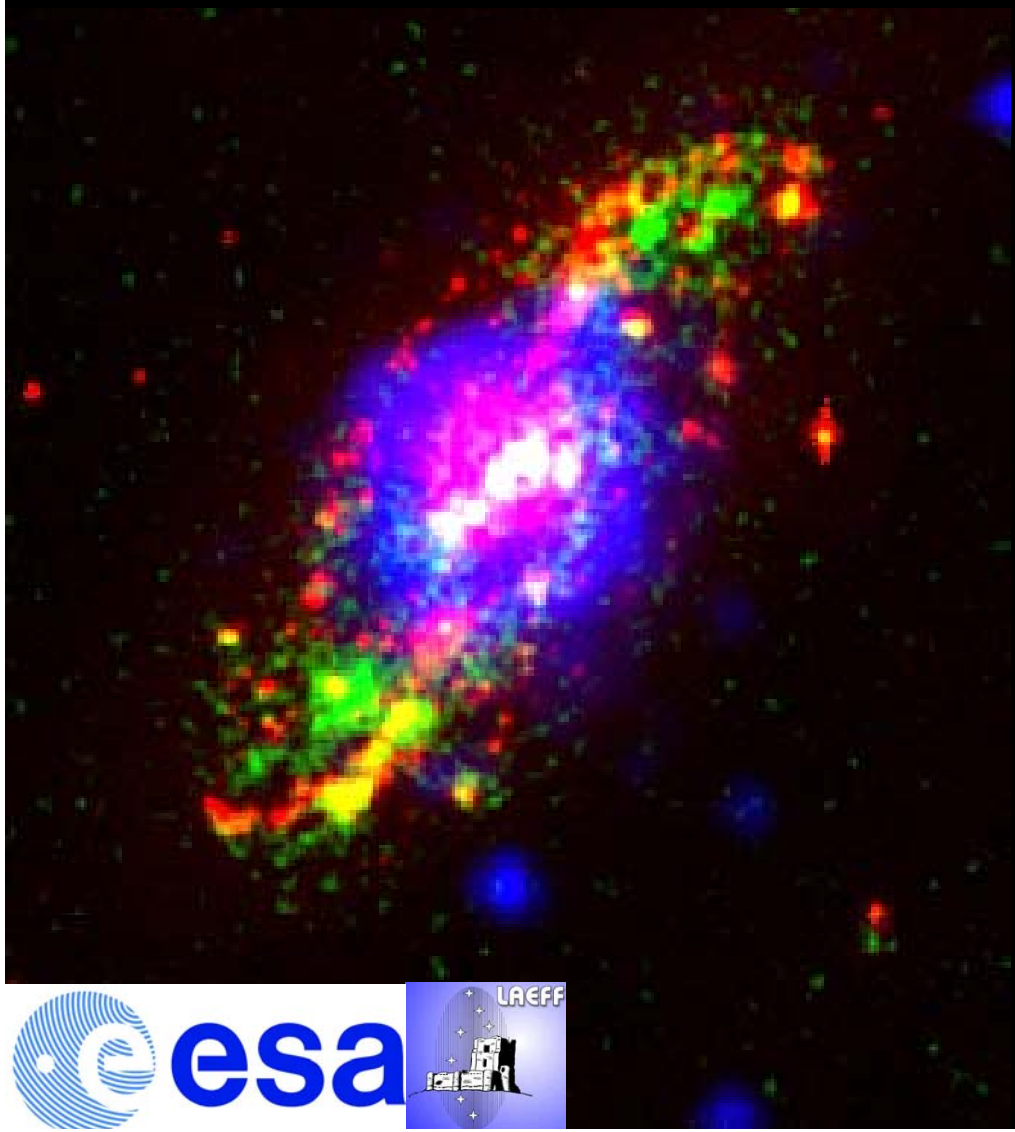
XMM-Newton Observation of the Seyfert 2 galaxy NGC 1808



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Introduction

X-ray Emission Sources (I)

- **Emission of AGNs**
  - L ~ $10^{38\text{-}43}$ erg/s
  - Power law $F_\nu = \nu^\alpha$, α=0.7-1.2 ***Reeves,00***
  - Absorbing material (torus, accretion disk, …)
  - Variability
- **Emission of Binary Systems**
  - L ~ $10^{37\text{-}38}$ erg/s
  - Depends on the nature of the compact object and the kind of accretion
- **Diffuse Emission of the Hot Gas**
  - Temperature of the hot gas T~10^7 K
  - Significant Contribution of the young stellar regions at < 1 keV
- **Interaction of IR photons with e^- of SN**

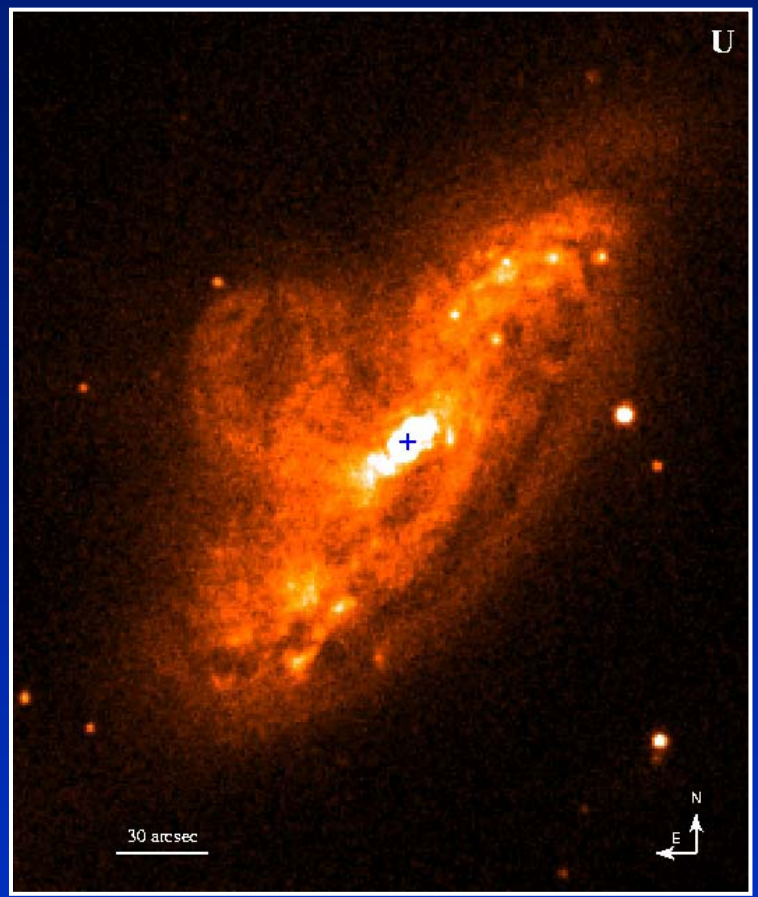
Introduction

X-ray Emission Sources (II)

- **Emission of SNR**
  - L ~ 10^{37} erg/s
  - Significant contribution at < 2 keV
- **Emission of Individual Stars**
  - L ~ $10^{32\text{-}33}$ erg/s
- **Emission of Ultraluminous X-ray sources (ULX)**
  - L $\geq$ 10^{39} erg/s
  - Yet unknown origin

General Properties of NGC 1808

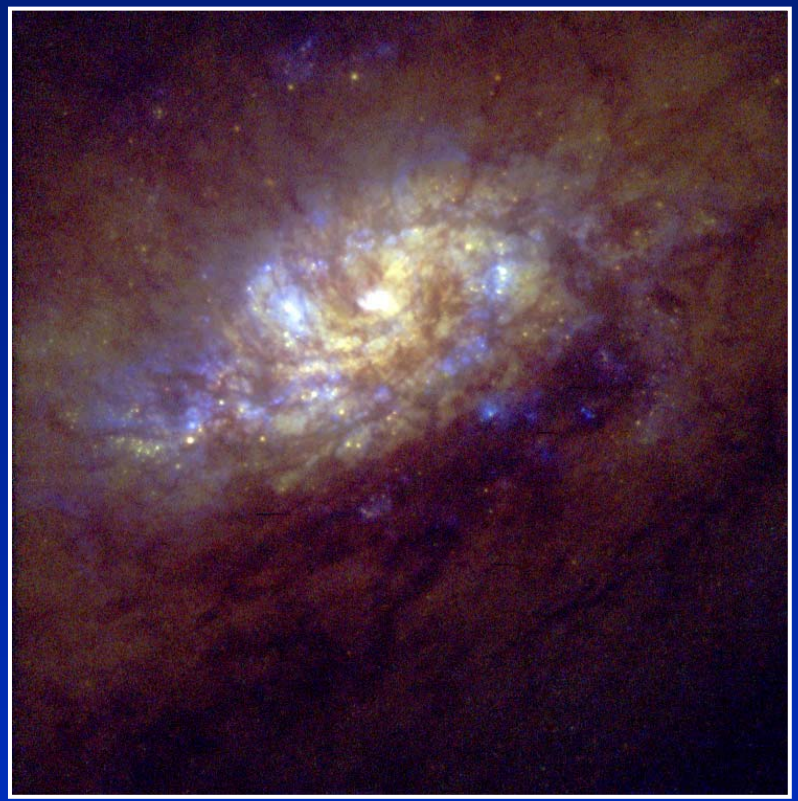
NGC 1808



- Spiral SBC
- D = 10.9 Mpc → 1″ ≡ 53 pc
- Central 1 kpc:
  - HII regions
  - SNR
  - Intense star-forming regions

General Properties of NGC 1808

NGC 1808



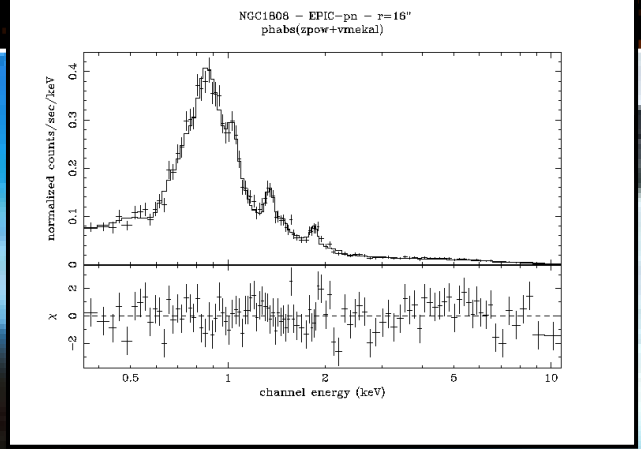
WFPC2 2x2 kpc^2

Nuclear Activity

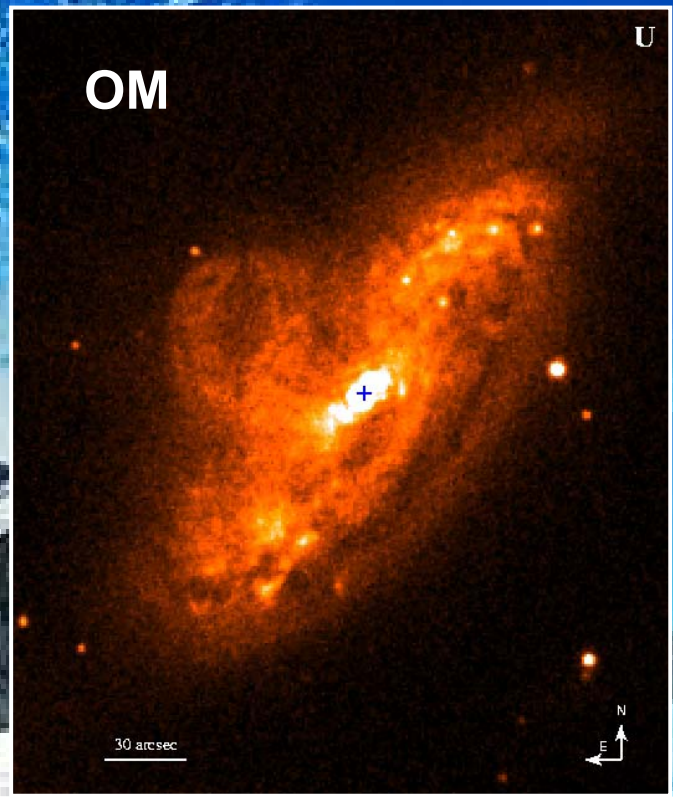
- Seyfert 2 or *Starburst* galaxy
- IR emission suggests the presence of star formation + additional source
- X-ray suggest a mixed origin: star formation + additional source

X-ray emission

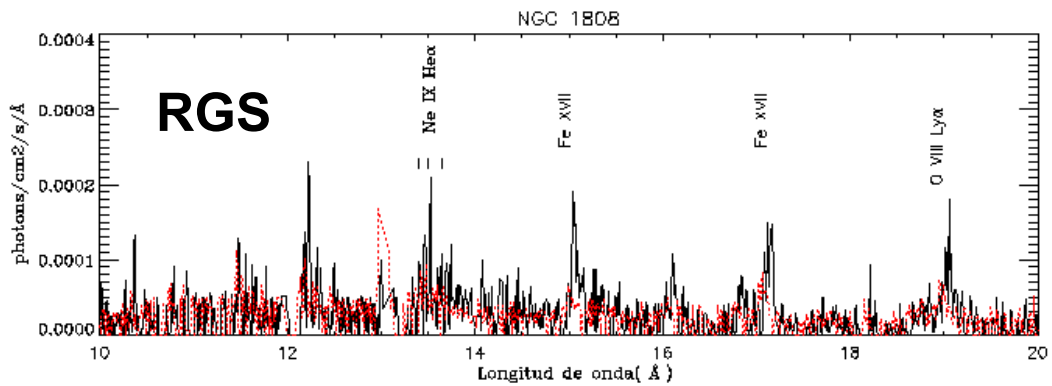
EPIC



OM

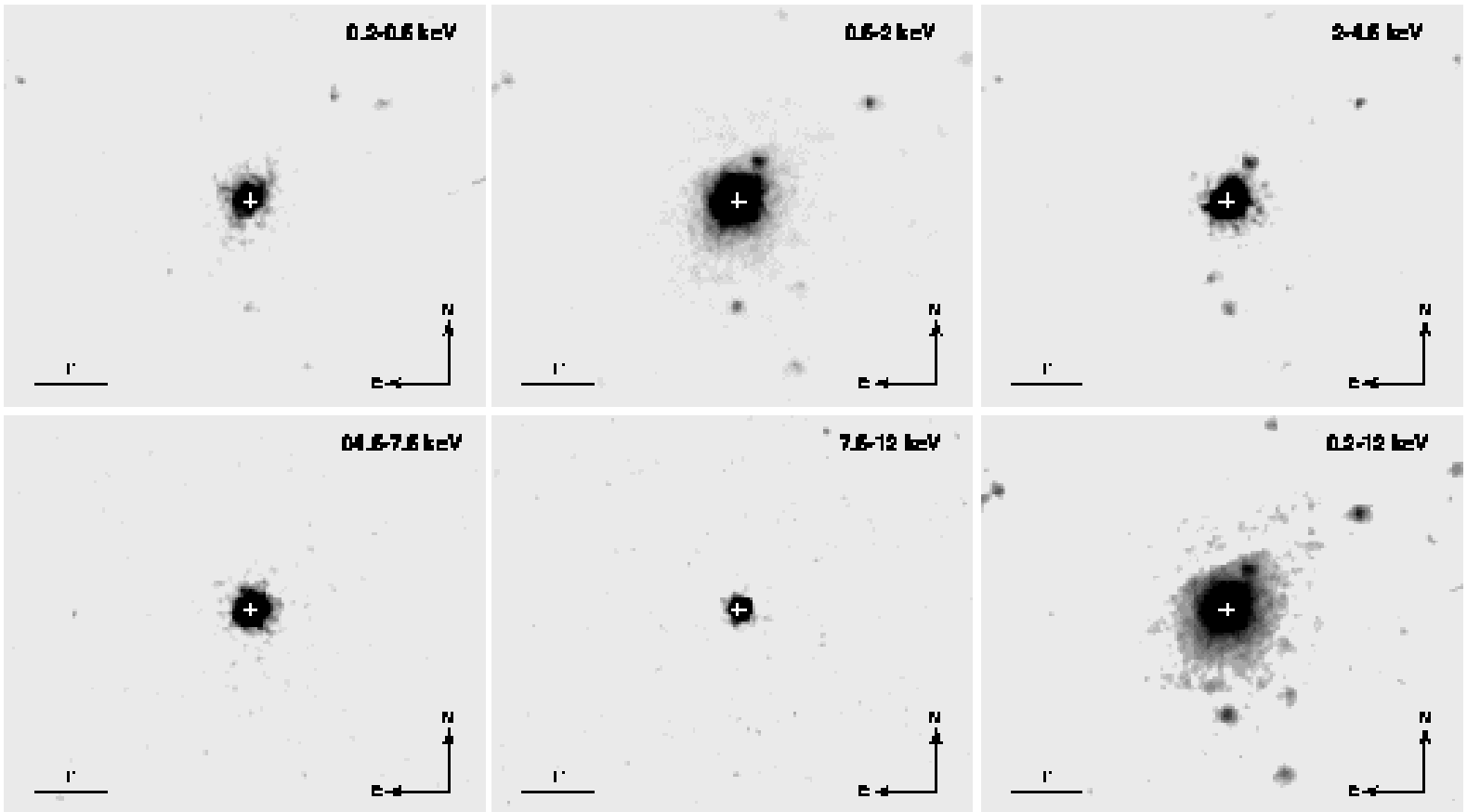


RGS



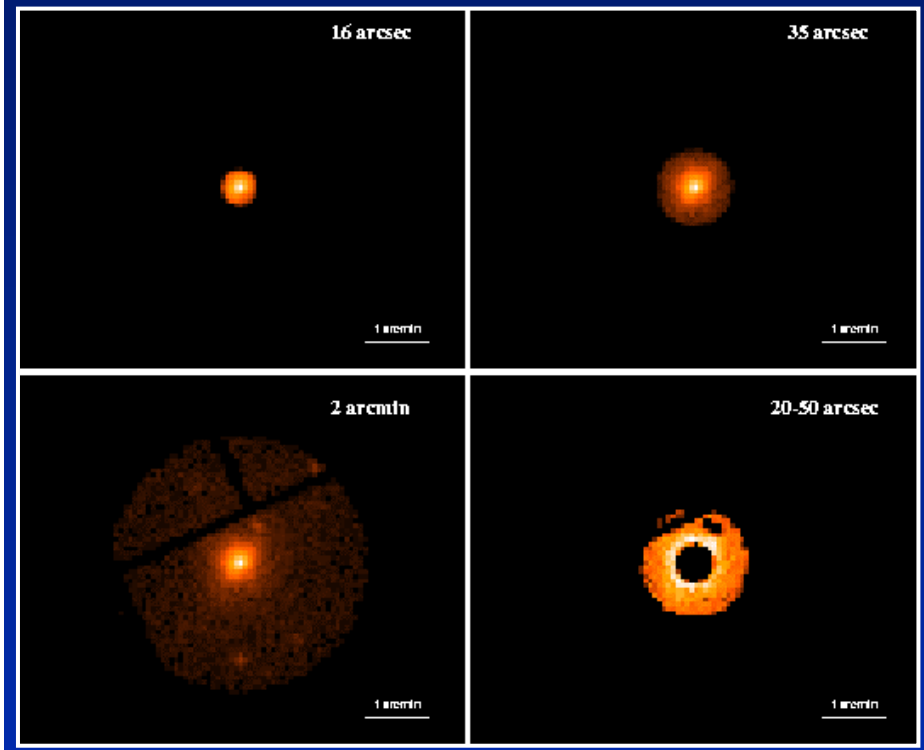
Morphology of the X-ray Emission

EPIC pn-MOS Imaging



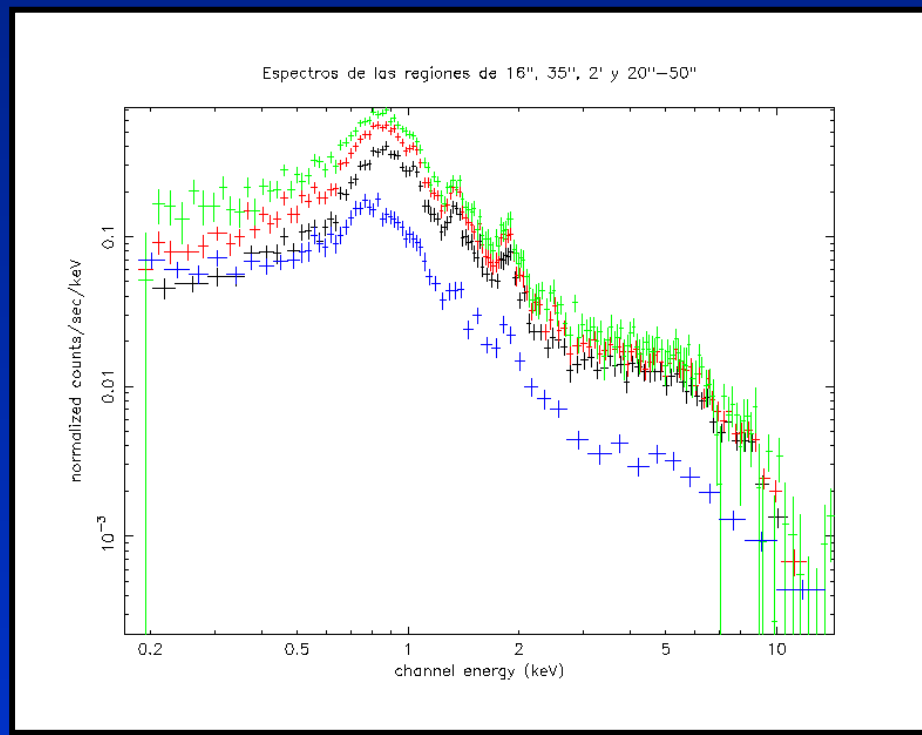
Nuclear X-ray Emission

Morphology of the emission



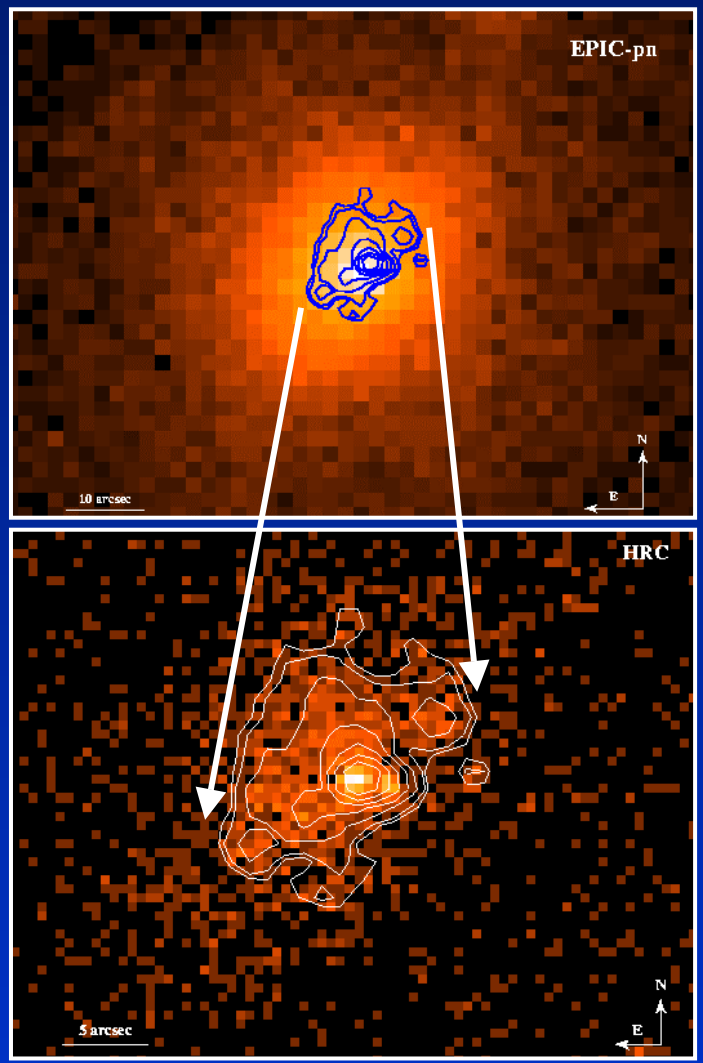
- The spectra of the outer regions are similar
- A main part of the hard X-ray emission is originated in the nucleus
- The nuclear X-ray emission is harder

Region 1 r = 16´´ (850 pc)
Region 2 r = 35´´ (1.9 kpc)
Region 3 r = 2´ (6.4 kpc)
Region 4 r = 20´´- 50´´ (1-2.7 kpc)



Morphology of the X-ray Emission

NGC 1808



- Extended emission
- Ultraluminous point-like X-ray sources in the central 600 pc

  $L_{2\text{-}10\ keV} \sim 10^{39}$ erg/s *Zezas, 01*

Spectral Analysis of the X-ray Emission

Nuclear region r = 850 pc

$\Gamma = 0.86 \pm 0.07$

$kT = 0.58^{+0.02}_{-0.07}$ keV $T = 6.6^{+0.2}_{-0.6} \times 10^6$ K

$[Ne]=1.5^{+0.9}_{-0.6}$ $[Mg]=2.0^{+0.9}_{-0.6}$ $[Si]=1.6^{+0.9}_{-0.6}$

$[Fe]=0.6^{+0.2}_{-0.1}$

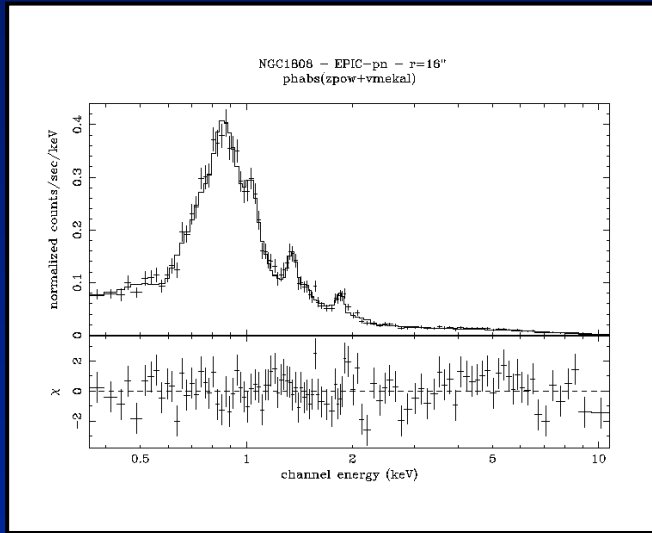
$\chi^2_\nu = 1.13$ with 94 degrees of freedom

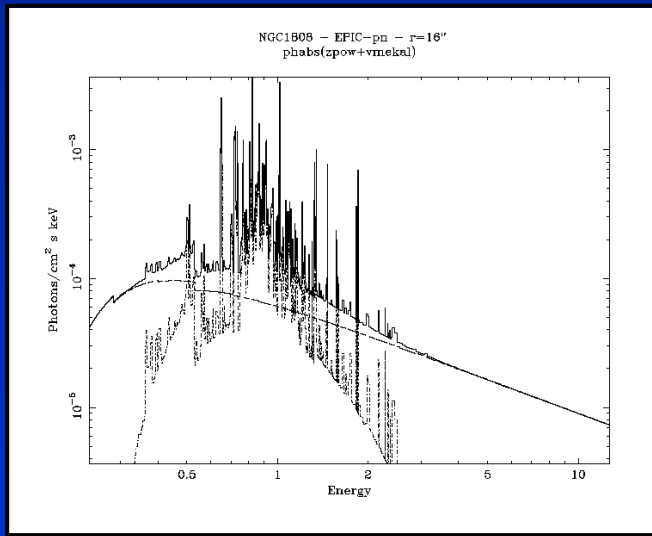
$L_{0.23\text{-}2keV} = 1.6 \pm 0.3 \times 10^{40}$ erg/s

- *25 % Power law*
- *75 % Mekal*

$L_{2\text{-}10keV} = 1.55 \pm 0.07 \times 10^{40}$ erg/s

- *98 % Power law*
- *2 % Mekal*

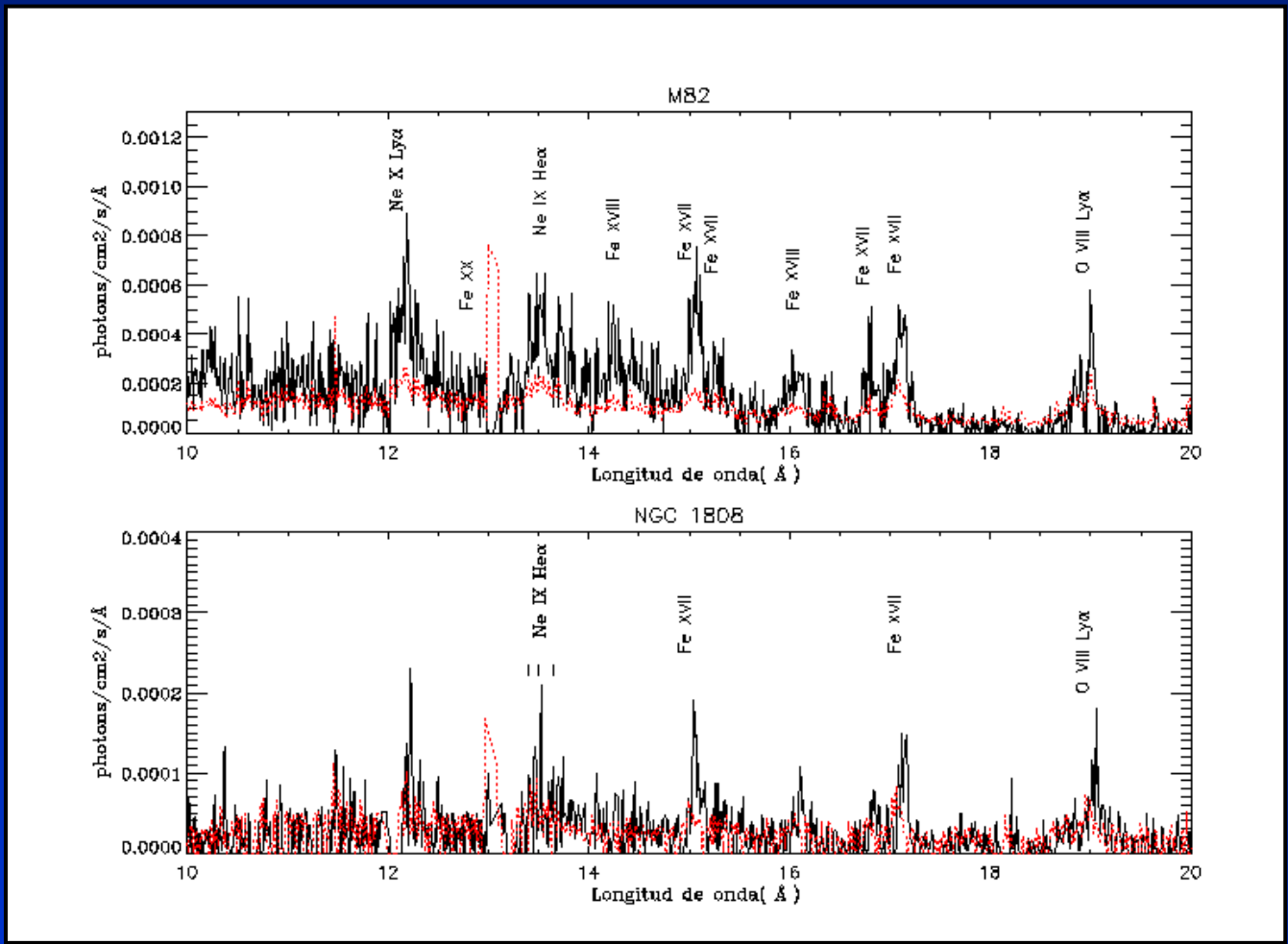




Spectral Analysis of the X-ray Emission

Analysis of the high resolution X-ray spectrum

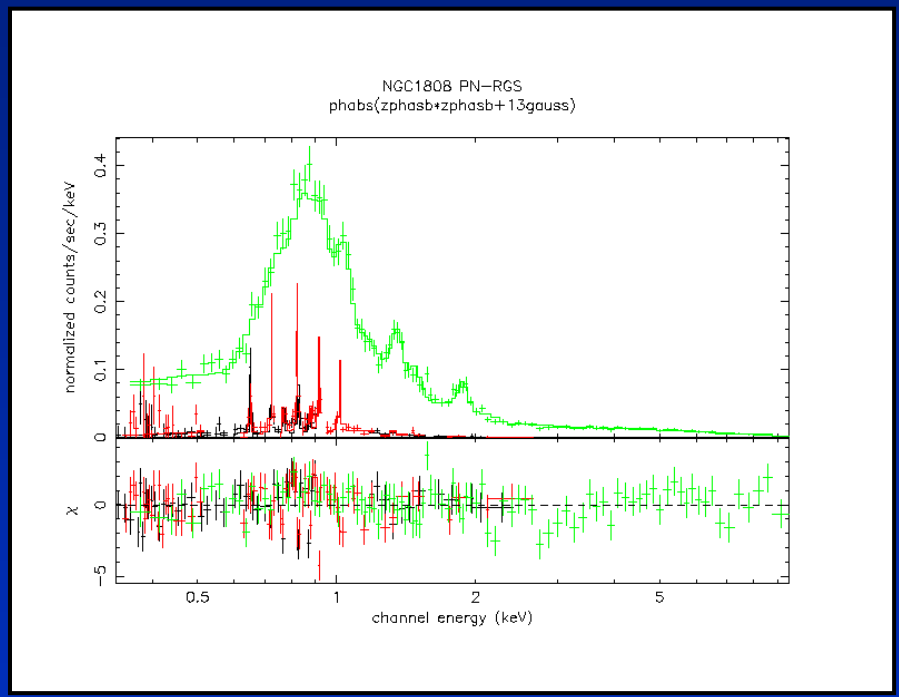
The high resolution spectrum obtained with RGS in very similar to the one obtained for M82

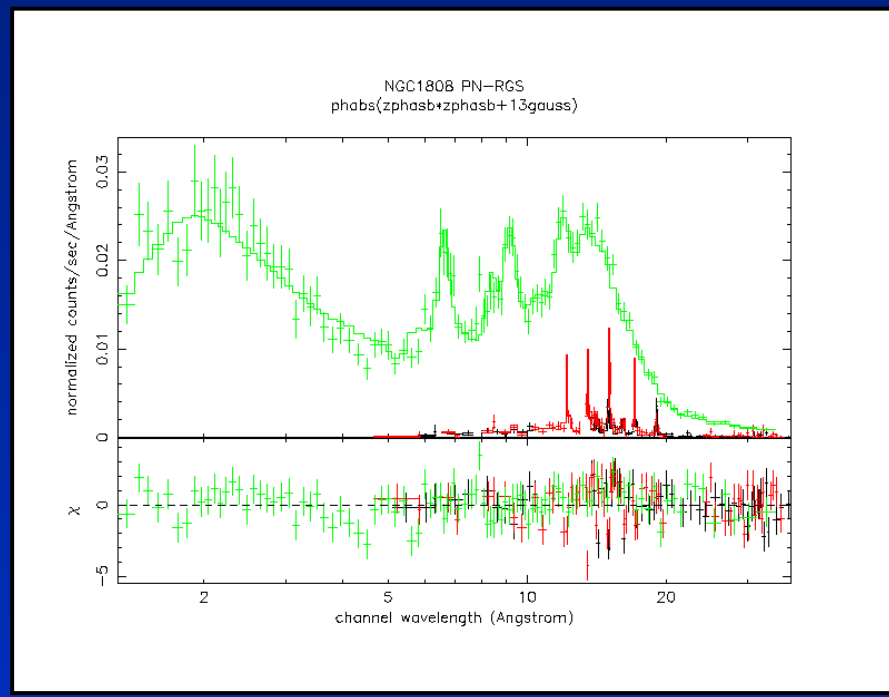


Spectral Analysis of the X-ray Emission

Analysis of the high resolution X-ray spectrum (II)

Simultaneous analysis PN y RGS
→ Power law + 13 emission lines of Si, Mg, Ne, Fe and O





Temperature, luminosity and ratios between emission lines are consistent with a being originated in a collisionally ionized plasma associated to SFR which dominates the total soft X-ray spectrum

Results on the Analysis of the X-ray Emissio

- **Morphology of the X-ray emission**
  - Extended emission
  - Unresolved source in hard X-rays
- **Spectrum of the extended region:**
  - Thermal emission → Related to the SF processes
- **Nuclear spectrum:**
  - Power law + thermal component
  - Index of the power law

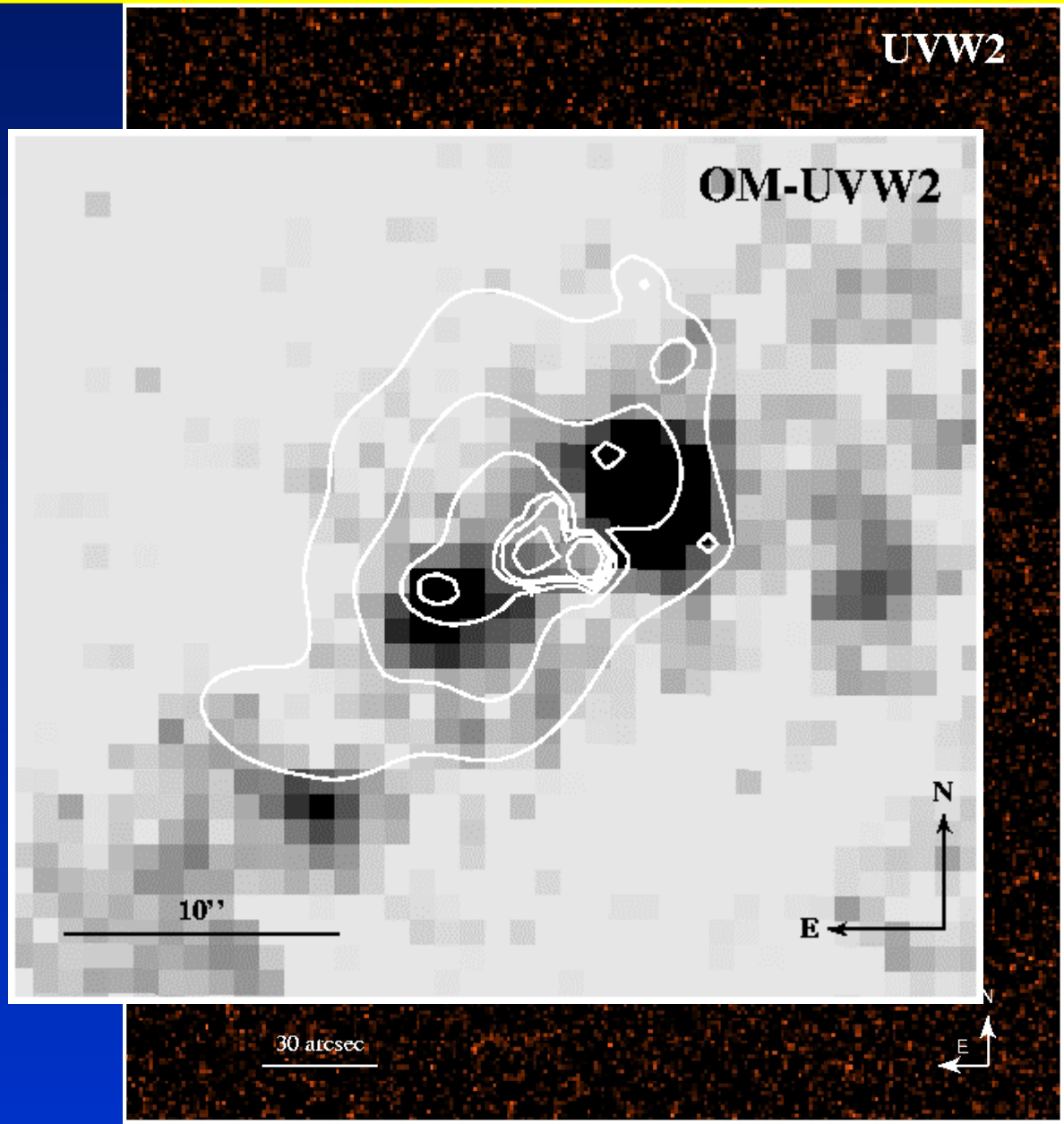
    Γ(NGC 1808)=0.9 lower than in active galaxies
  - Luminosity compatible with Seyfert 2 and LINERS or an ultraluminous X ray source (ULX)

The study of the X-ray nuclear emission suggests the coexistence of ar active galactic nuclei (or an ULX) and star formation regions

Analysis of the optical-UV Emission

NGC 1808

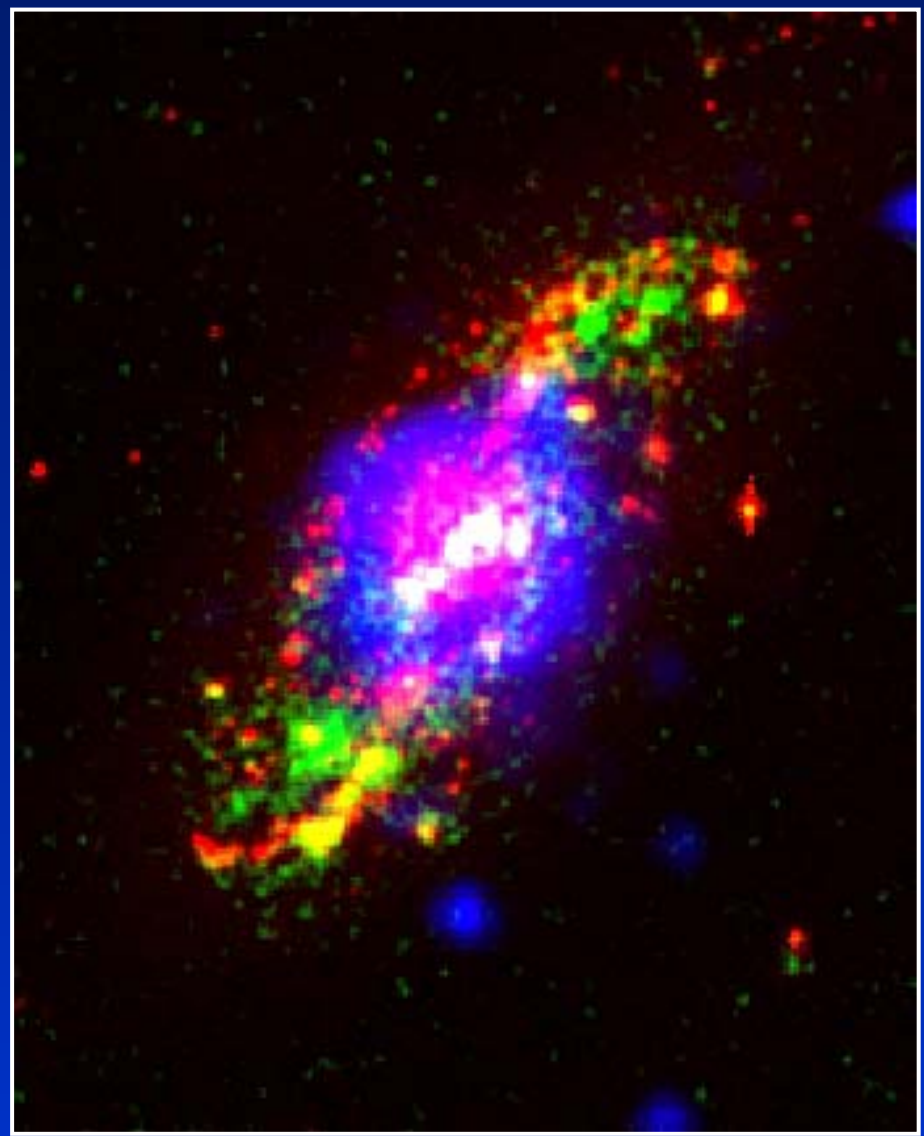
- Star forming regions are located in the spiral arms and bar
- Correlation between UV and X-rays



Analysis of the optical-UV Emission

NGC 1808

X-rays → **BLUE**
UV emission → **GREEN**
Hα emission → **RED**



Conclusions

- The spectral analysis of the EPIC spectra shows that the emission of the point-like source is dominated by hot gas in soft X-rays, but an additional source is producing most of the hard X-ray emission

- The emission of the hard X-ray point-like source is consistent with the presence of an active galactic nucleus, but it is not possible to rule out other possibilities (ULX)