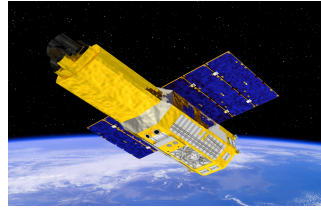# Discovery of the Extended X-ray Emission from the Dark Accelerator HESSJ1614-518

Hironori Matsumoto (Kyoto University)

H. Uchiyama, M. Sawada, T. G. Tsuru, K. Koyama (Kyoto U.)
H. Katagiri, R. Yamazaki (Hiroshima U.), K. Mori (Miyazaki U.),
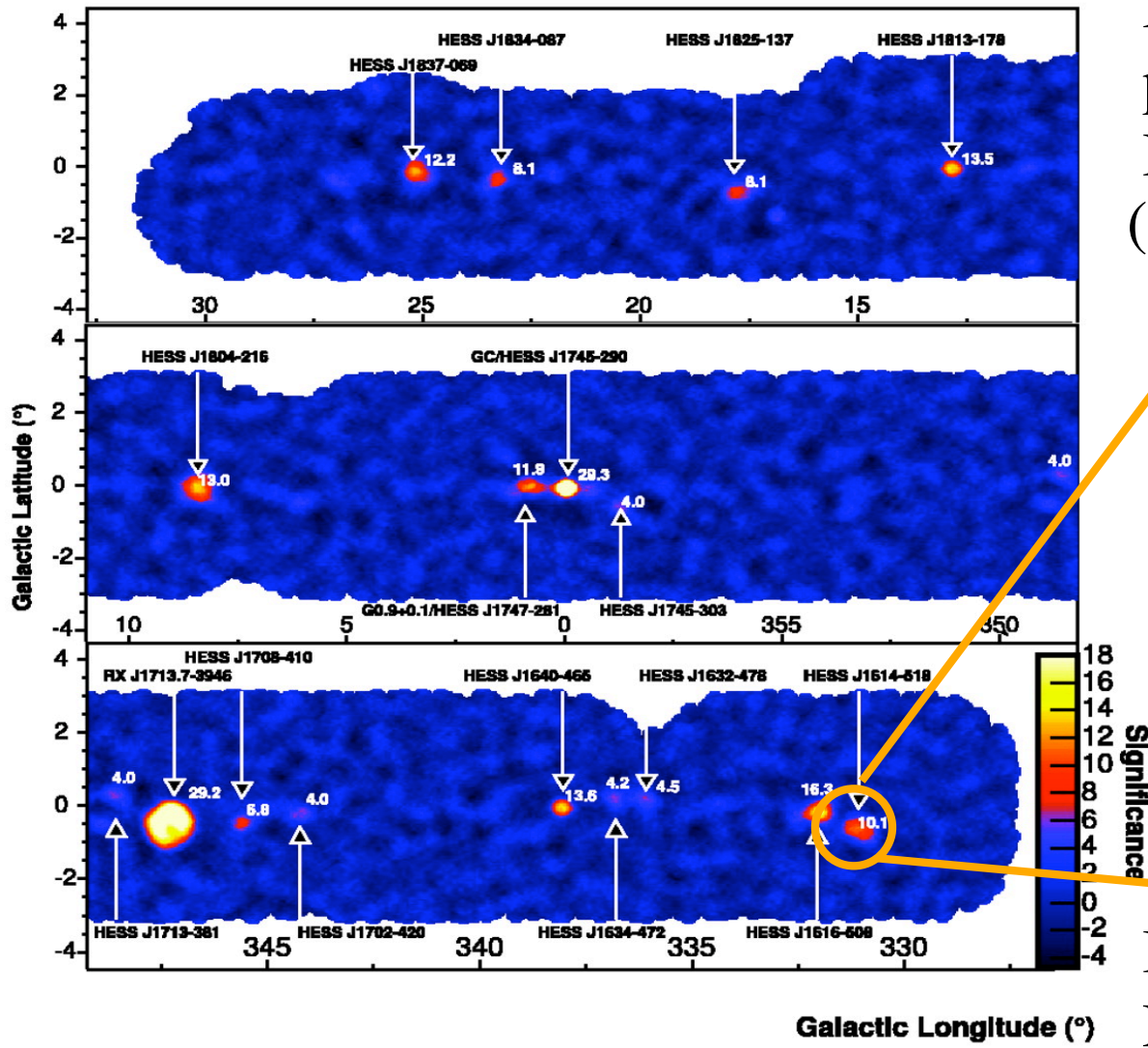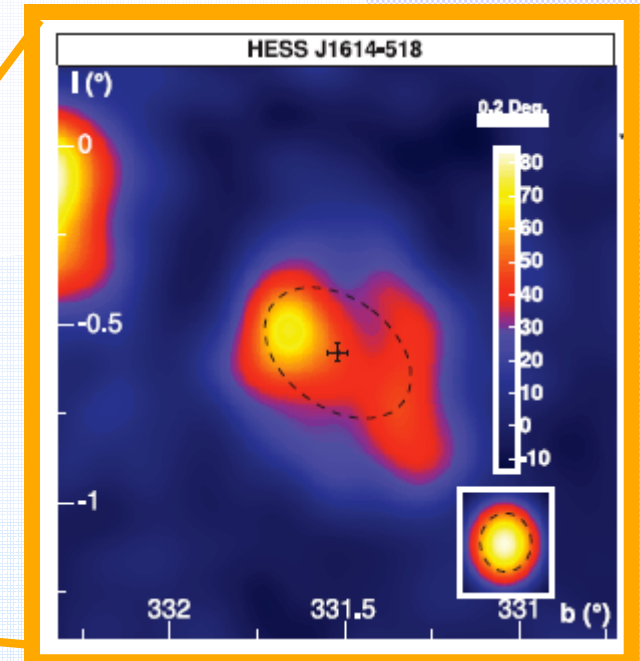A. Bamba, Y. Uchiyama (ISAS/JAXA), K. Kazunori (Lancaster U.)

Outline

■ HESS unID object: HESSJ1614-518

■ Suzaku observation of HESSJ1614-518

   ◆ Discovery of an extended X-ray counterpart

   ◆ Other two X-ray objects

   ◆ Discovery of extended soft X-ray emission
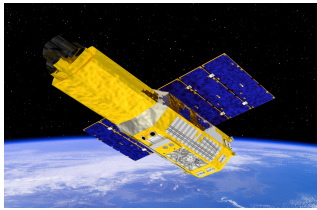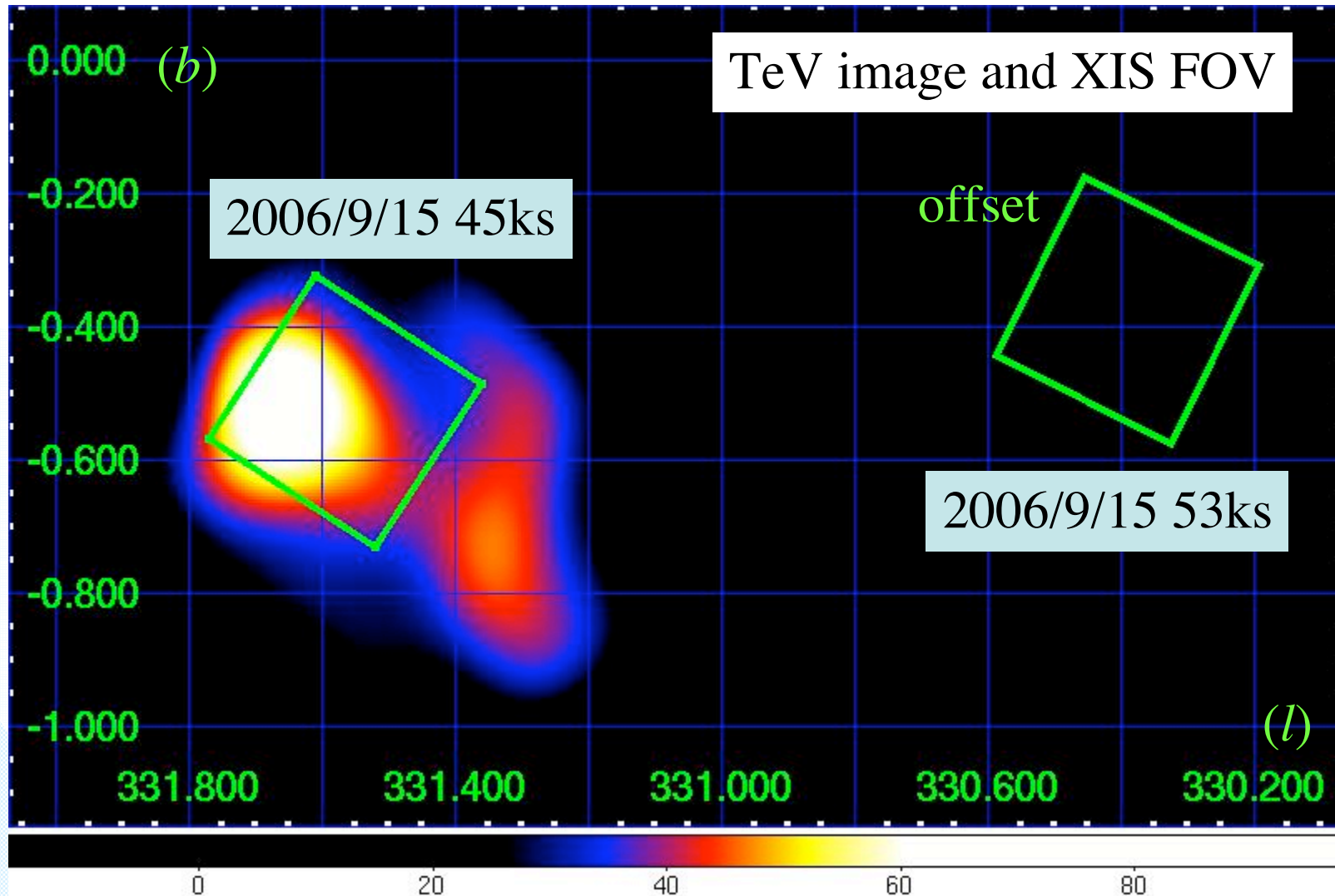
■ Discussion

■ Summary
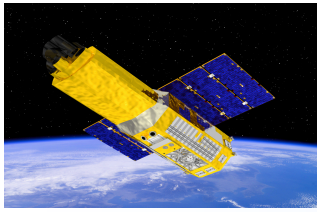
TeV γ -ray object: HESSJ1614-518

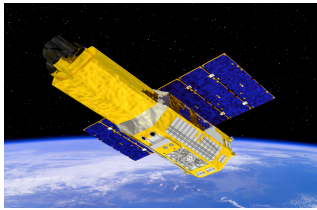Discovered by the Galactic plane survey with the H.E.S.S. telescope. (Aharonian et al. 2005,2006)

Brightest object:
F(1-10TeV)=1.8e-11 erg/s/cm2

Suzaku Observation

TeV image and XIS FOV

(b)

2006/9/15 45ks

offset

2006/9/15 53ks

(l)

Normal mode without the speced-row charge injection

XIS image (FI CCD)

0.4-3keV 3-10keV
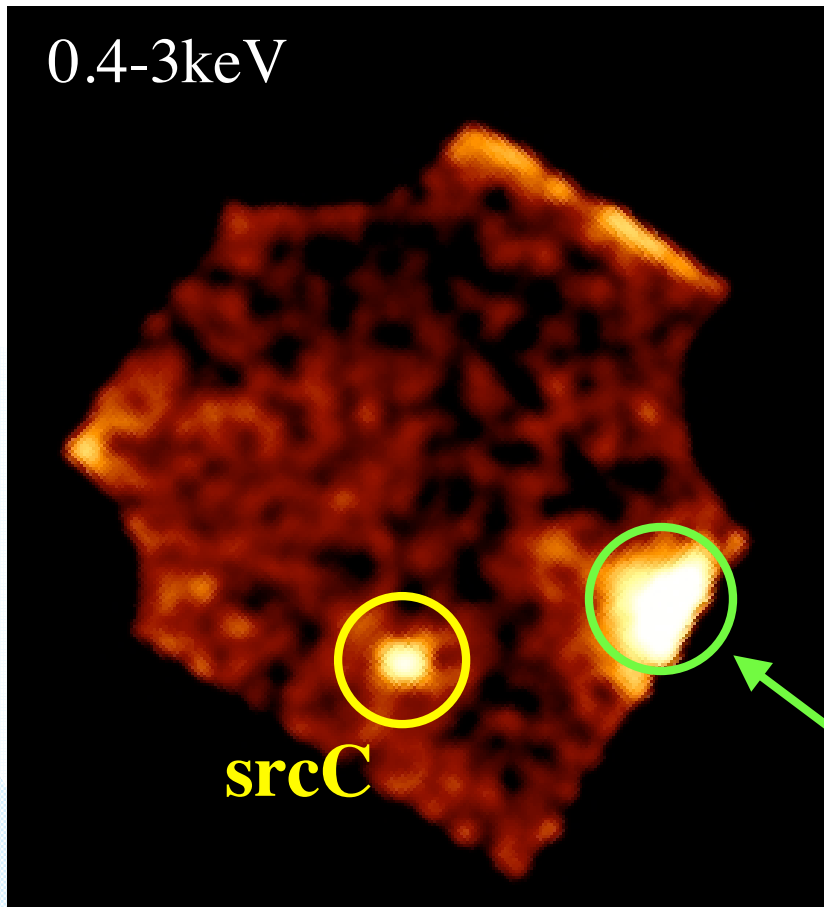
srcA
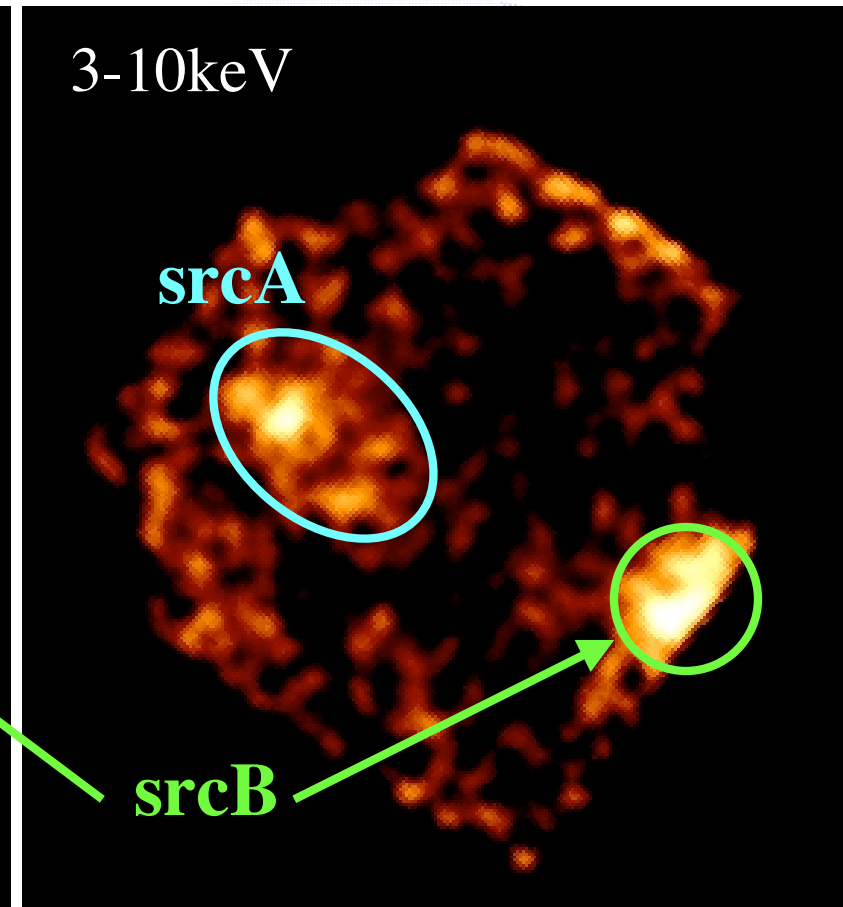
srcC

srcB

Discovery of three X-ray objects

srcA, srcB: extended, srcC: point like

Comparison with the HESS image
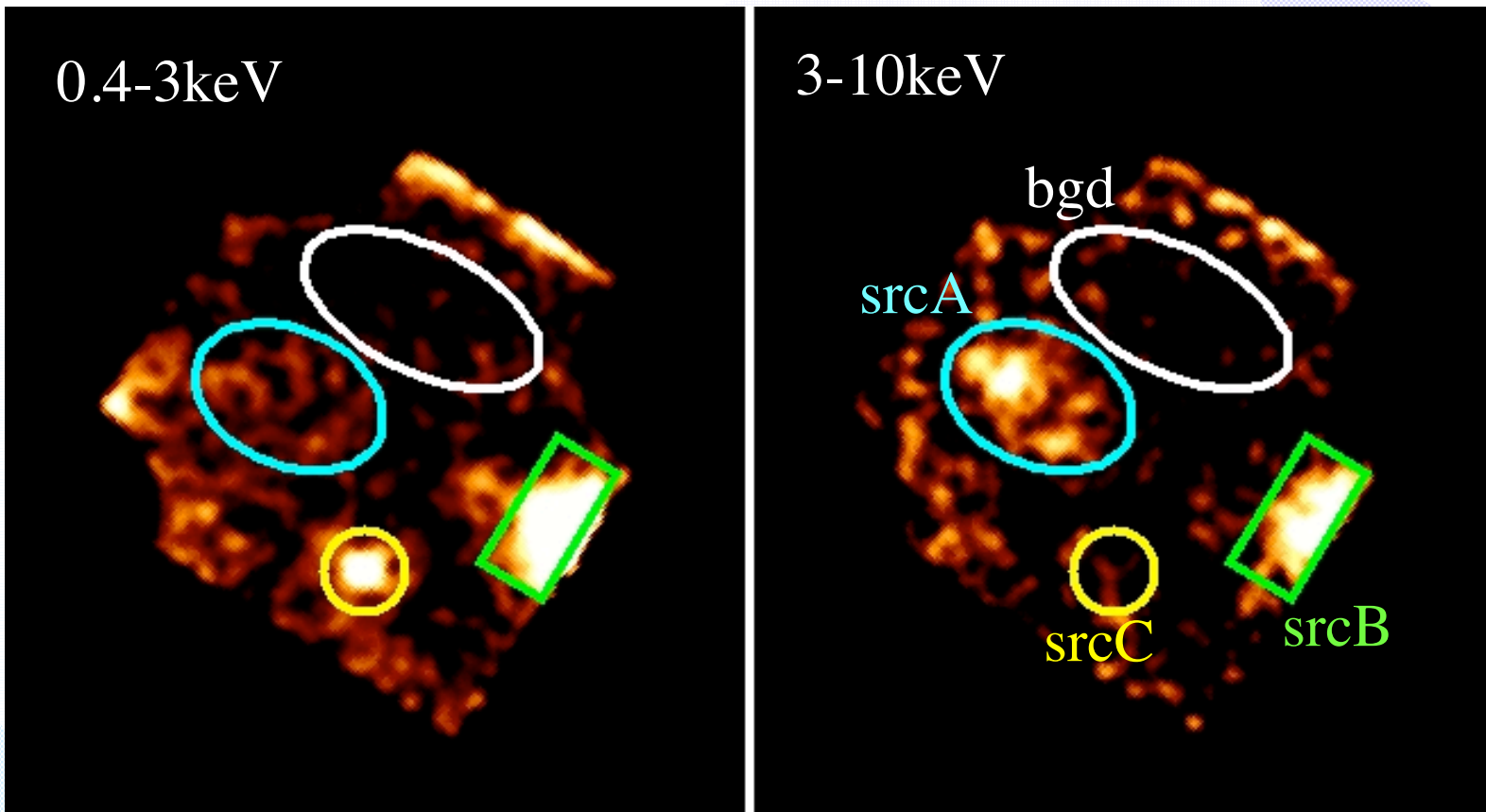
TeV image

3-10keV

srcA

0.4-3keV

srcB

srcC
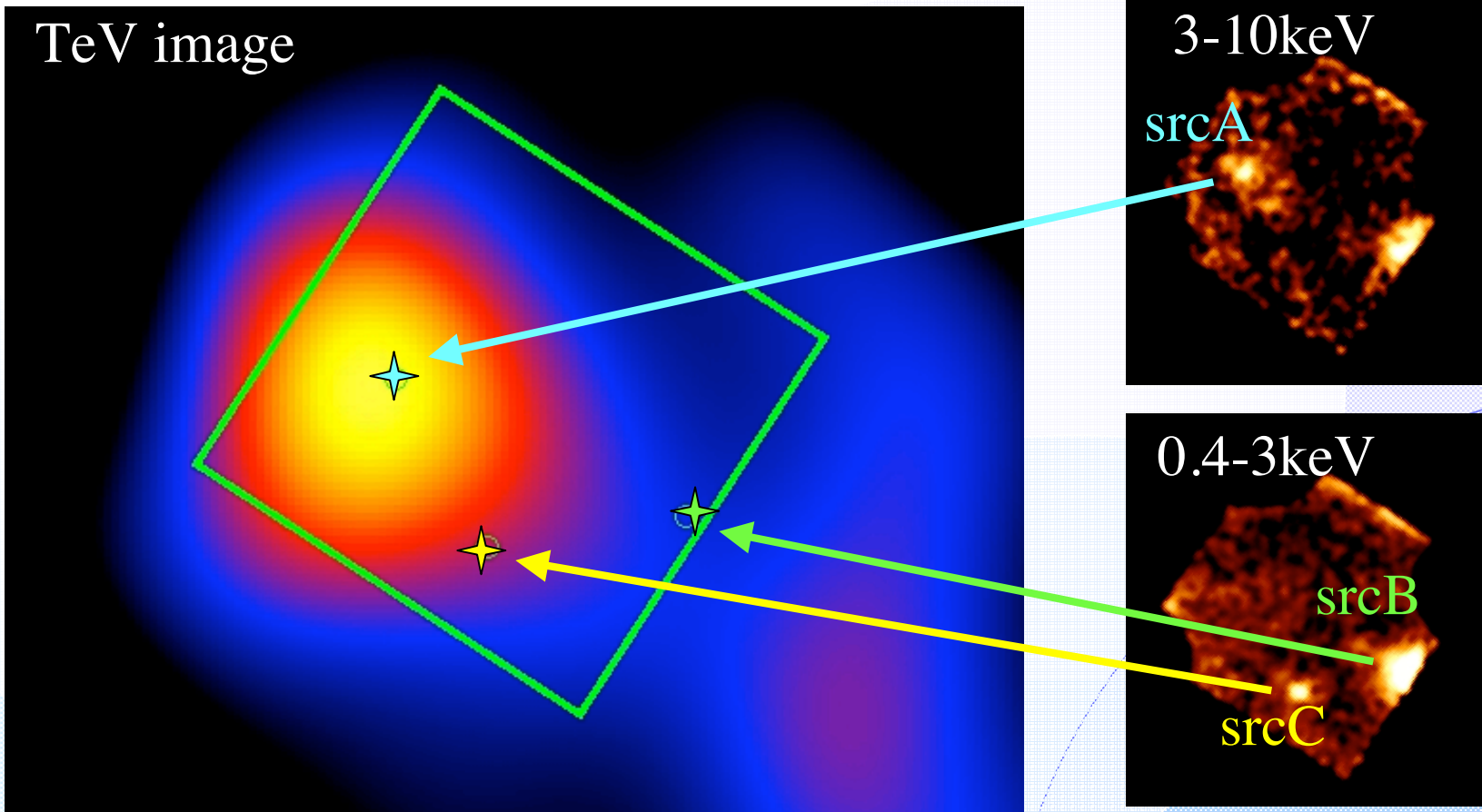
Src A is spatially coincident with the TeV gamma-ray.
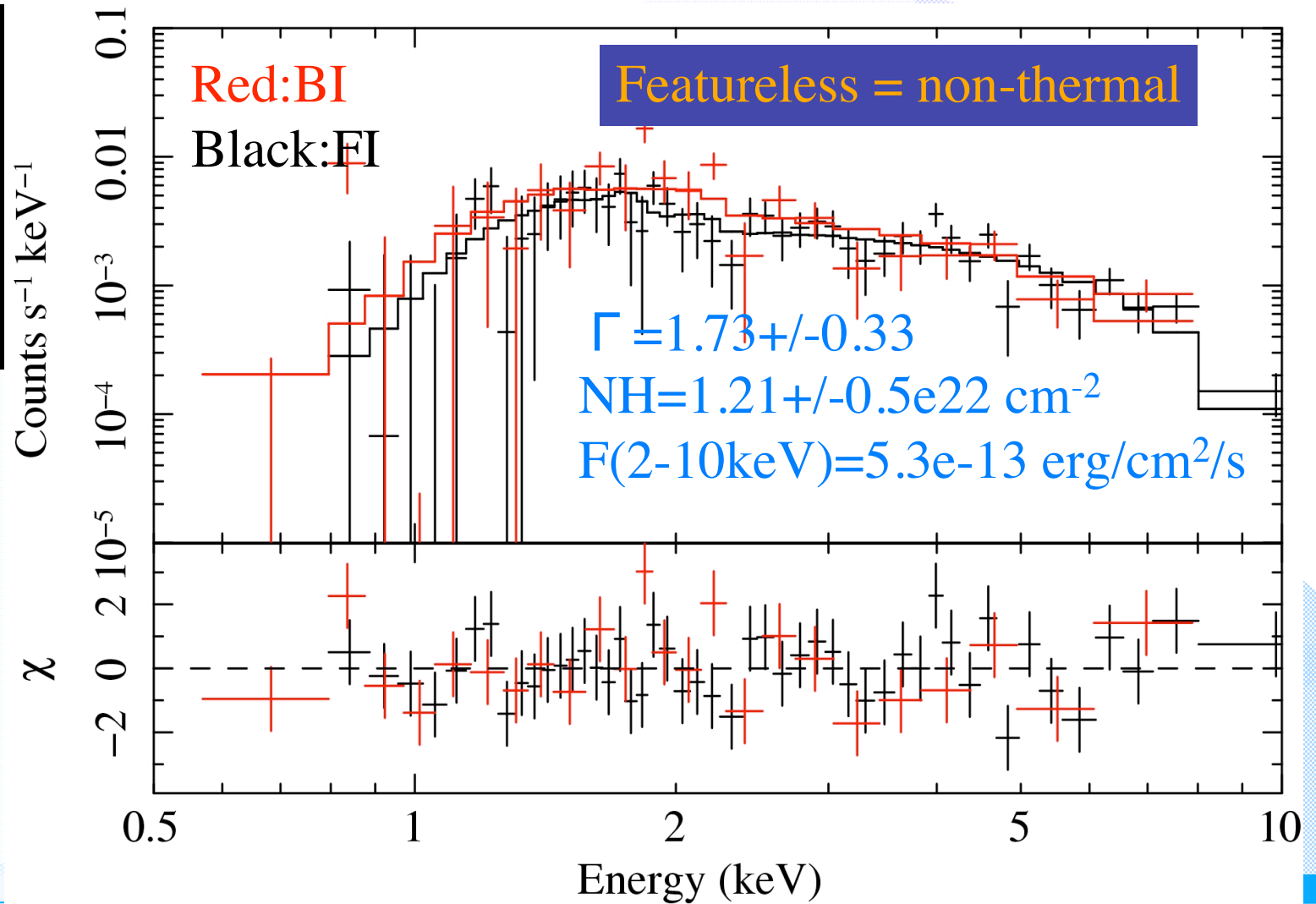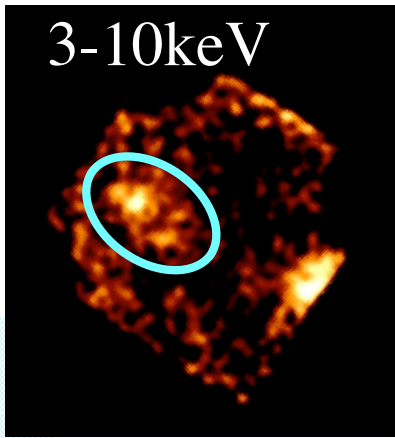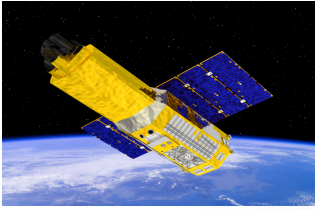
Spectral Analysis

Definition of spectral regions and a background.

(The offset observation is not used as a background. Explain later.)

Spectrum of src A

3-10keV

Red:BI

Black:FI

Featureless = non-thermal

$\Gamma = 1.73 +/- 0.33$

$NH = 1.21 +/- 0.5e22$ cm^{-2}

$F(2\text{-}10keV) = 5.3e\text{-}13$ $erg/cm^2/s$

Counts s^{-1} keV^{-1}

χ

Energy (keV)

Discussion: Src A

Src A is a plausible counterpart to HESSJ1614
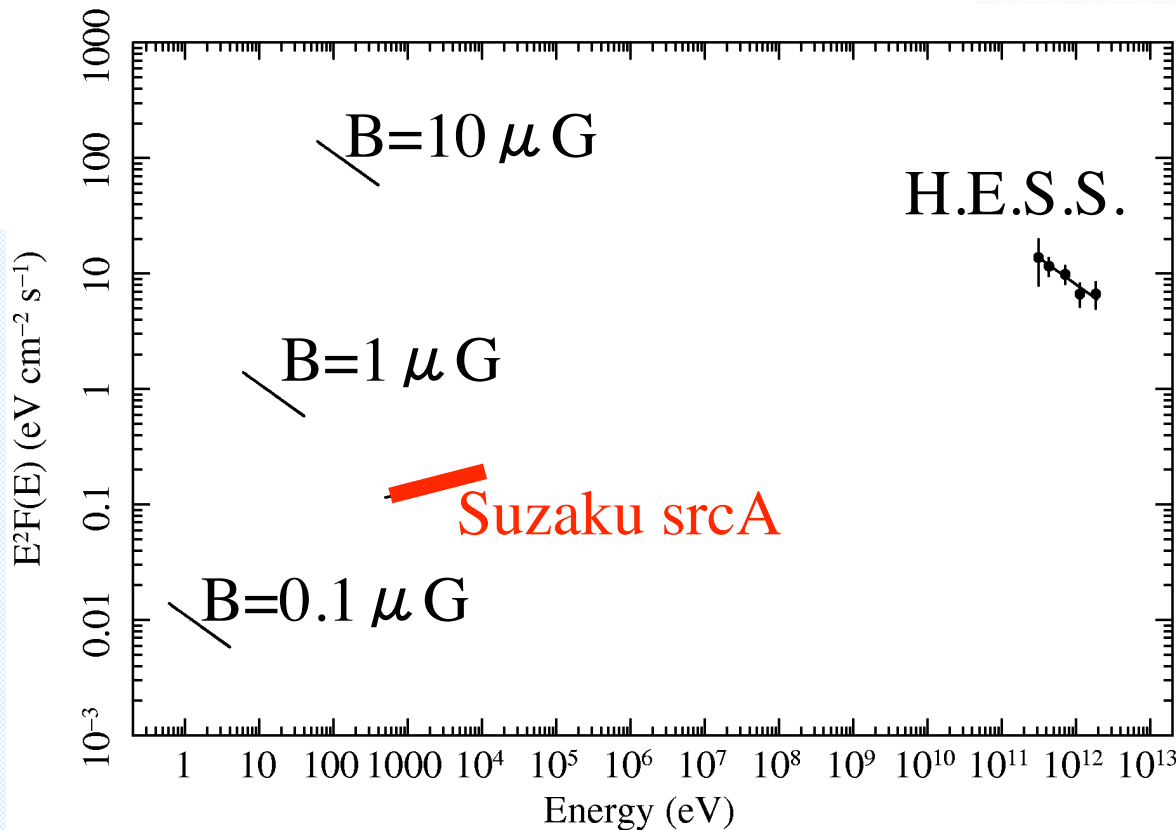
F(1-10TeV)/F(2-10keV)=34

One of the largest ratios.

Other Suzaku results
- HESSJ1616-508: >55
  (Matsumoto et al. 2007)
- HESSJ1804-216: ~ 25
  (Bamba et al. 2007)

If the origin of the TeV emission is the inverse Compton of the CMB by high-energy electrons, the magnetic field must be too small.

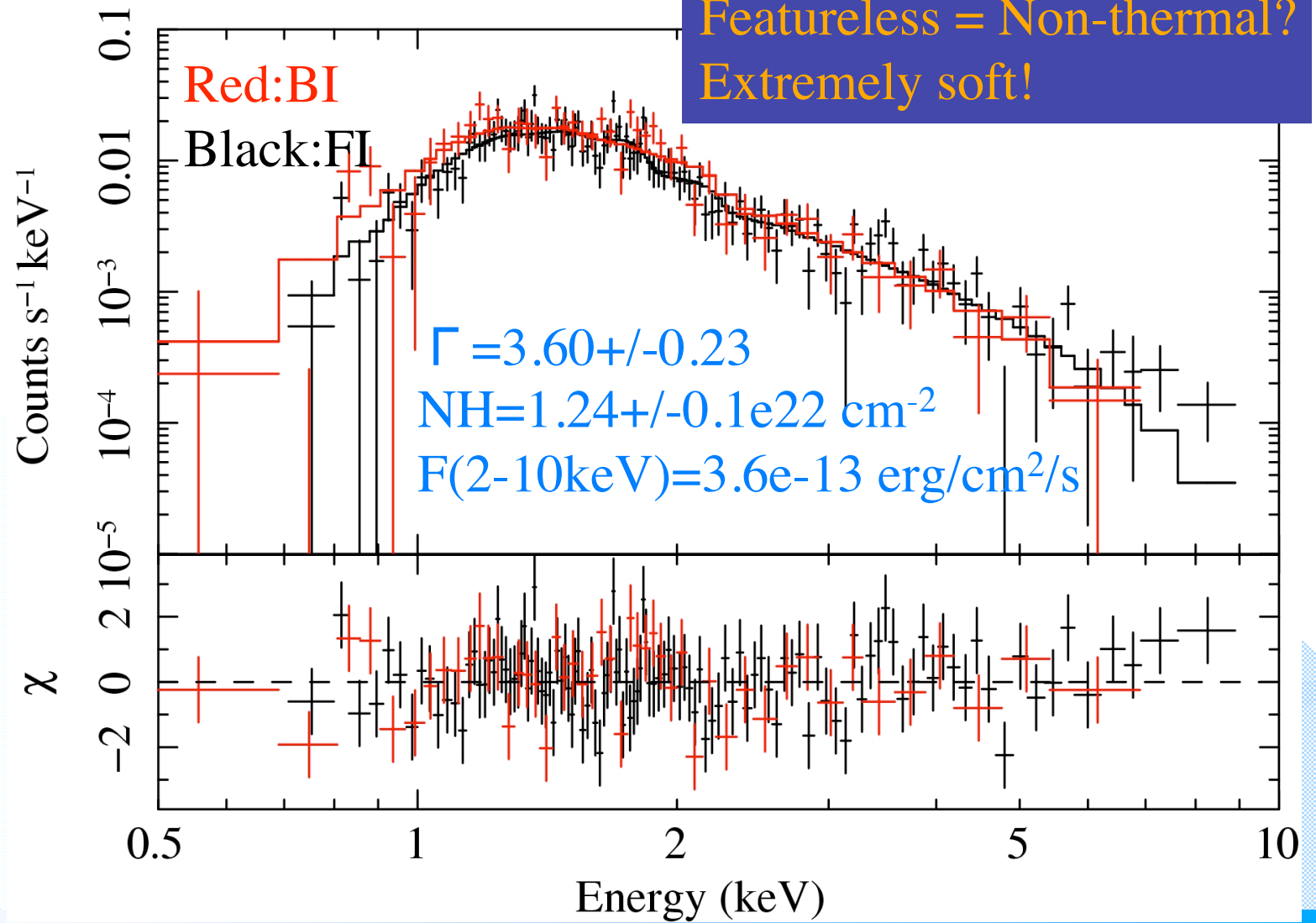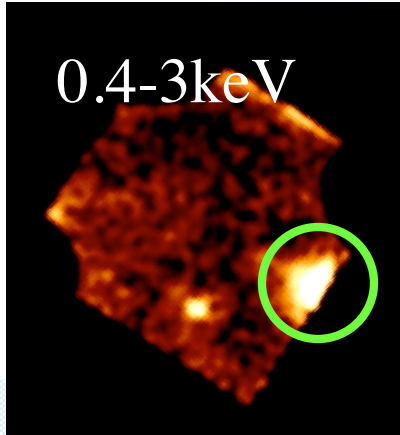# Discussion: src A

- No counterpart in other wavelengths.
- NH ~ 1.2e22 cm^{-2}
  - ◆ D ~ 10 kpc (c.f. NH (HI survey) ~ 2e22 cm^{-2})
  - ◆ Lx(2-10keV) ~ 6e33 erg/s
- ν photon index = 1.7
  - υ Harder than the canonical SNR values (2.5-3.0)
  - υ Non-thermal brems. emission from loss-flattened electron distribution? (e.g., γ Cygni; Uchiyama et al. 2002)
  - υ Old SNR? (Yamazaki et al. 2006)
  - υ PWN?

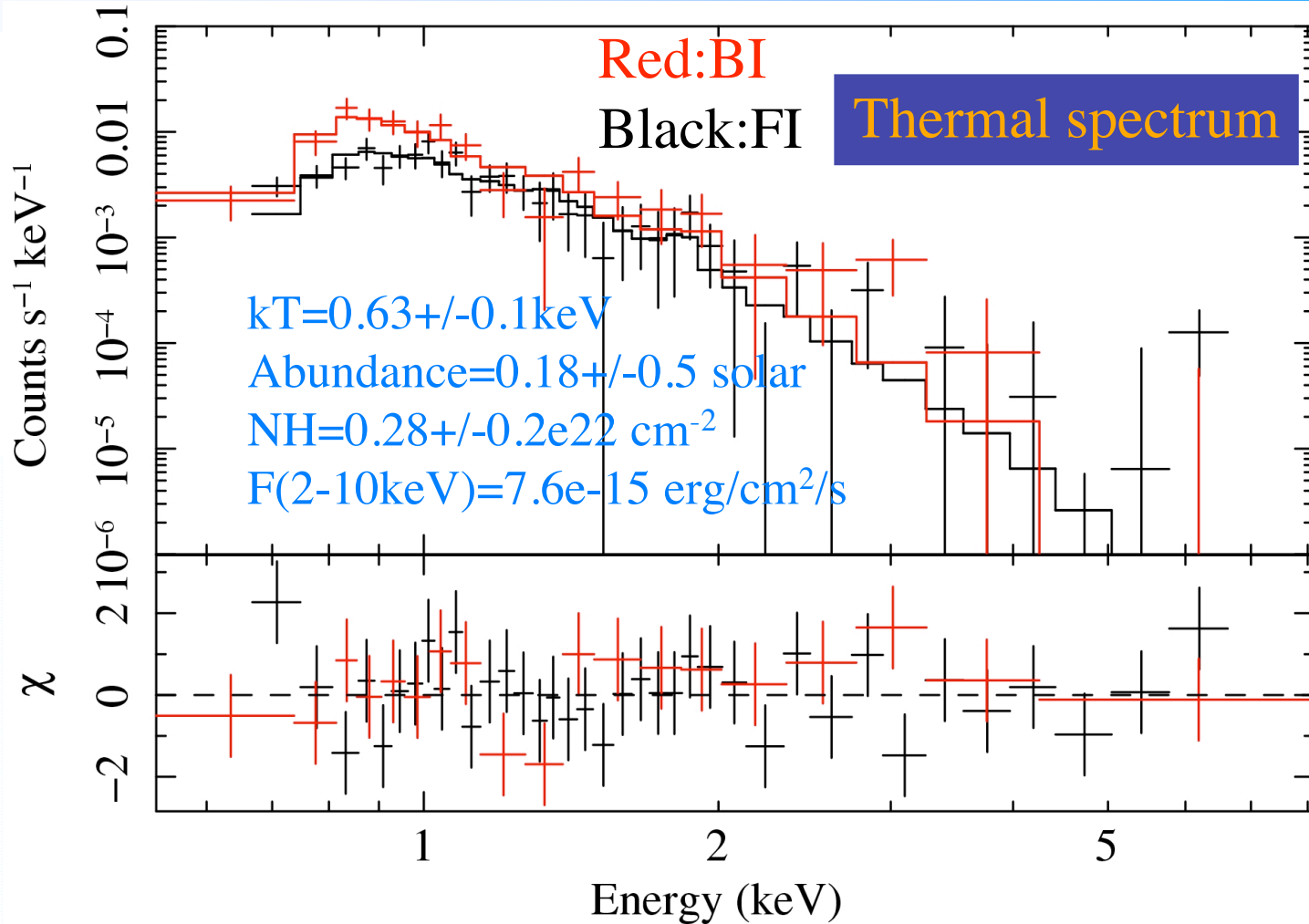# Spectrum of srcB

0.4-3keV

Featureless = Non-thermal?
Extremely soft!

Red:BI
Black:FI

$\Gamma = 3.60 +/- 0.23$
NH$=1.24 +/- 0.1e22$ cm^{-2}
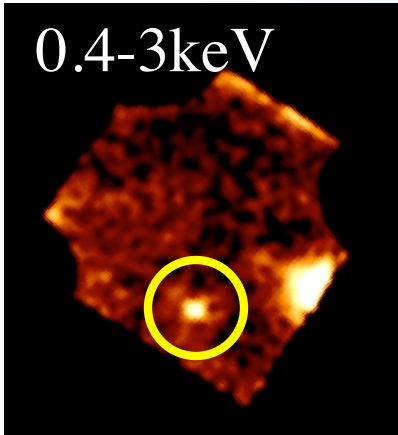F(2-10keV)$=3.6e$-13 erg/cm^2/s

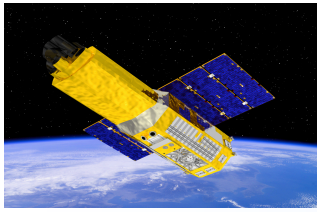Counts s^{-1} keV^{-1}

χ

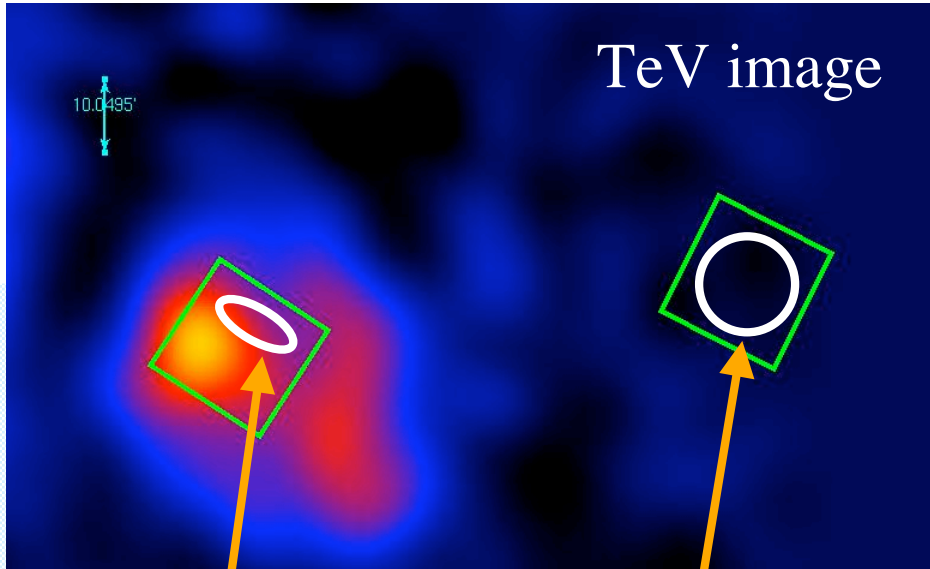Energy (keV)
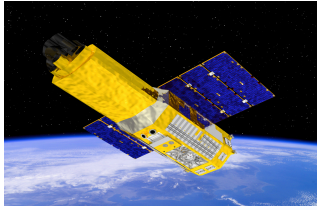
Discussion: src B

- **Spatially coincident with 2MASS J16140610-5152264**
  - ◆ The origin of the object is not clarified.
- **Previously detected with Swift XRT in March 2006: variable?**
  - ◆ F(2-10keV): Swift 1.4e-13 erg/s/cm^2 (Landi et al. 2007)
    - Suzaku 3.6e-13 erg/s/cm^2 (large err.)
- **Extremely large photon index (3.6)**
- **NH ~ 1.2e22 cm^{-2}**
  - ◆ Same as that of src A.
  - ◆ Physically related to HESSJ1614?
  - ◆ Src A= offset PWN and src B = pulsar?
    - (e.g. PSRJ1809-1917 associated with HESSJ1809-193
    - has a large photon index of 3.2+/-0.4; Kargaltsev & Pavlov 2007)

Spectrum of src C

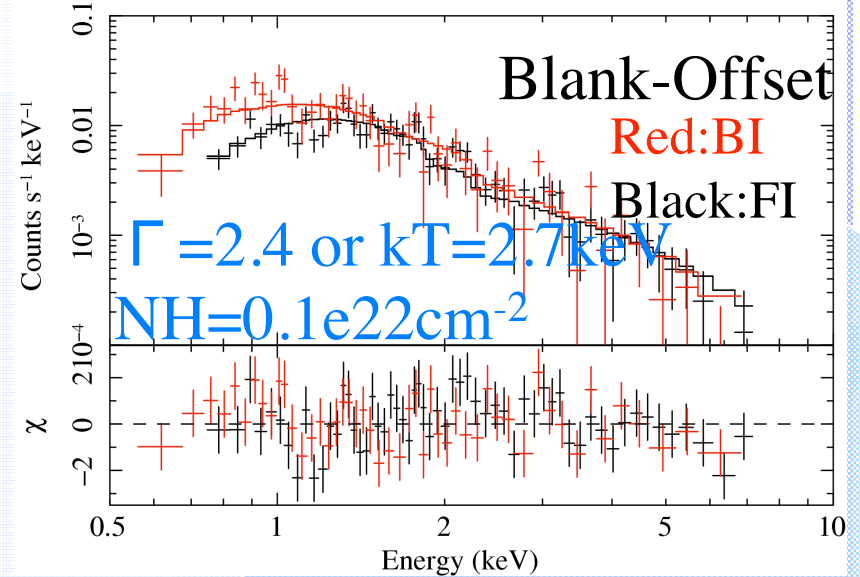0.4-3keV

Red:BI

Black:FI

Thermal spectrum

kT=0.63+/-0.1keV
Abundance=0.18+/-0.5 solar
NH=0.28+/-0.2e22 cm^{-2}
F(2-10keV)=7.6e-15 erg/cm^2/s

Probably the foreground B9V star HD145703

Diffuse soft X-ray emission

TeV image

BI spectrum

- blank
- offset

Blank-Offset

Red:BI

Black:FI

Γ =2.4 or kT=2.7keV
NH=0.1e22cm^{-2}
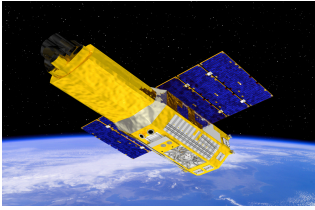
Blank region as a background

Offset region. No X-ray and gamma-ray objects.

NH→foreground   emission? Not related to HESSJ1614?
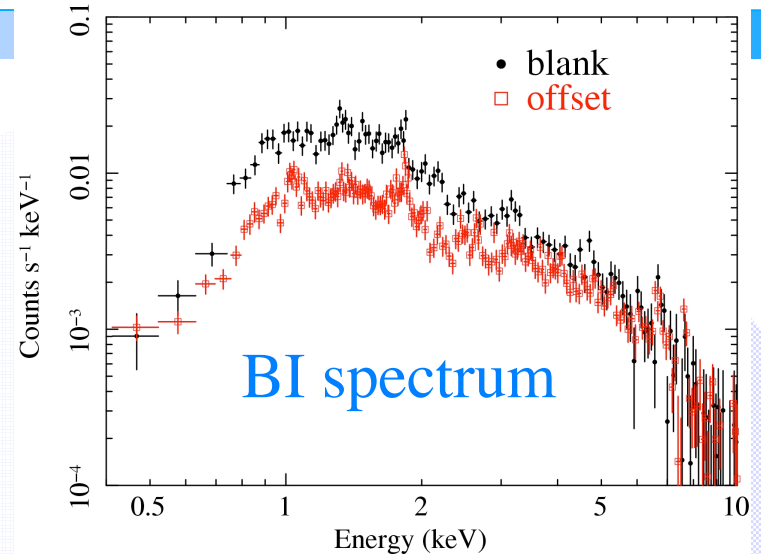
Summary

- **Discovery of three X-ray objects.**
  - ◆ Src A
    - ● Extended and spatially coincident with HESSJ1614.
      - – Plausible counterpart to HESSJ1614.
    - ● F(1-10TeV)/F(2-10keV) = 34
      - – It is difficult to explain the ratio in terms of high-energy electrons.
    - ● Photon index = 1.7
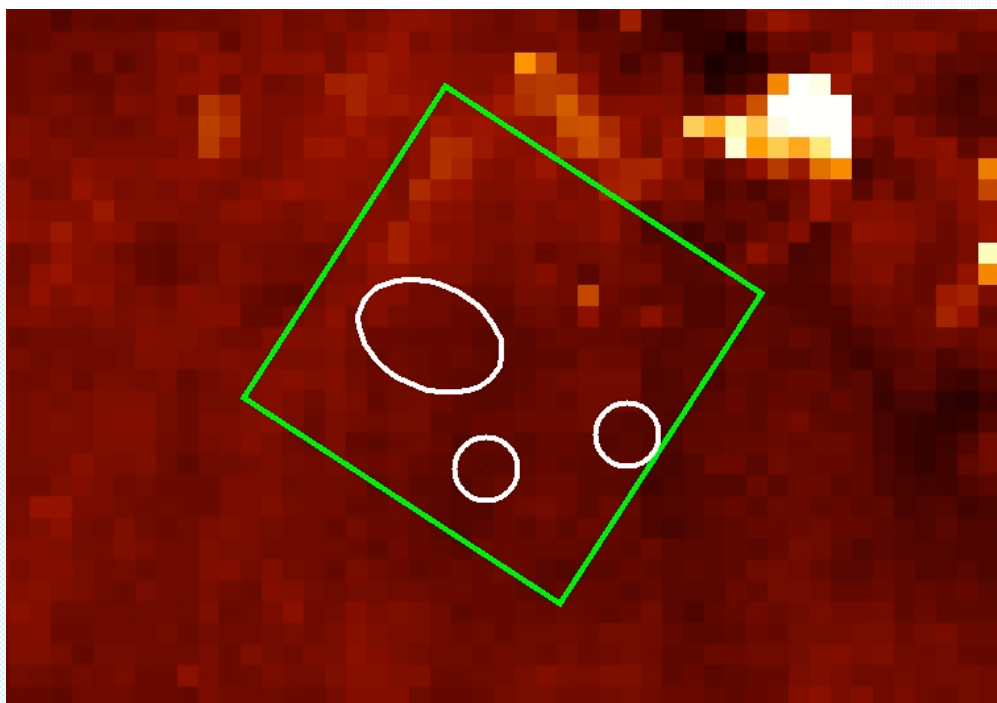   - – Different from the SNR values.
  - ◆ Src B
    - ● Column density suggests that src B may also be physically related to HESSJ1614. Pulsar?
  - ◆ Src C … foreground star
- **Discovery of the extended soft X-ray emission.**

他波長イメージ

SUMSS 843MHz survey

CO map