The Origin of the 6.7-keV line in the Galactic Center Region Suggested by the Suzaku and NIR Data

T.G.Tsuru, M.Nobukawa, Y.Hyodo, K.Koyama (Kyoto U.) and the Kyoto GC team

evnivtsev et al. (2006)

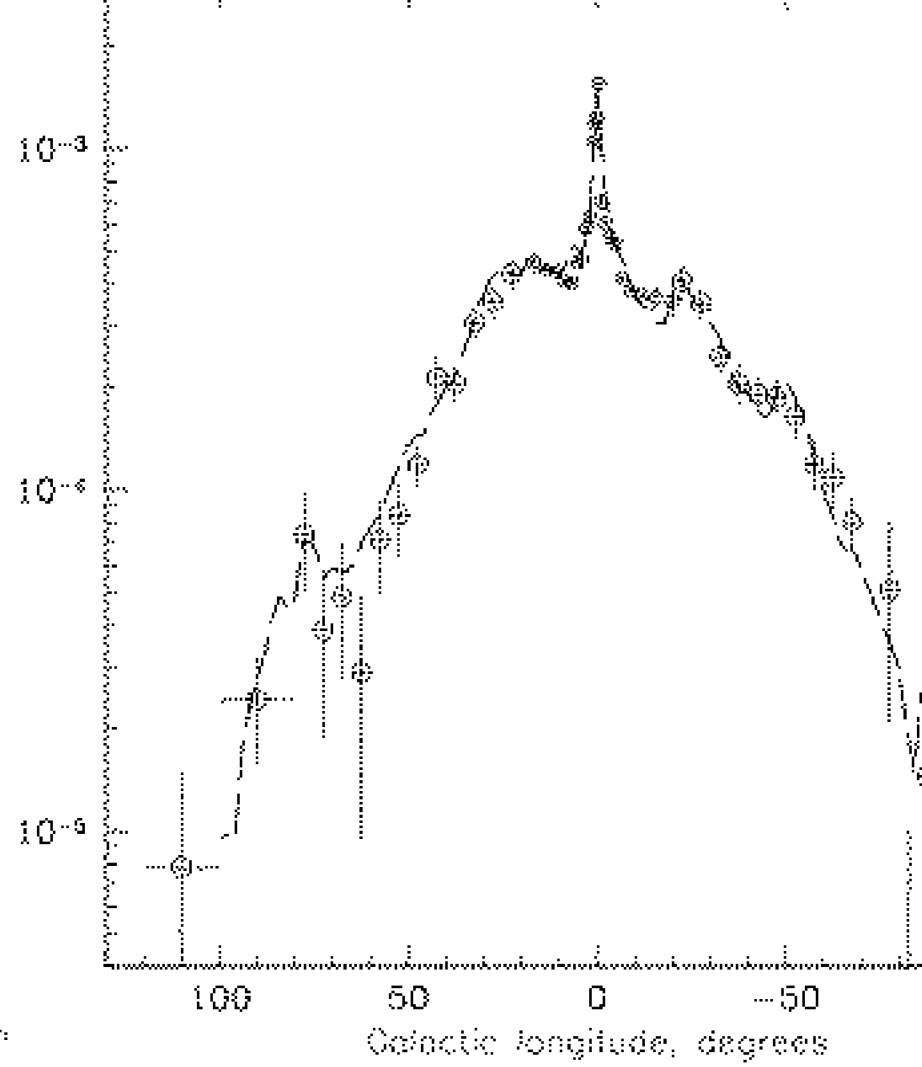
urface brightness of
DIRBE 4.9_m - the one of
PCA 6.7keV line.

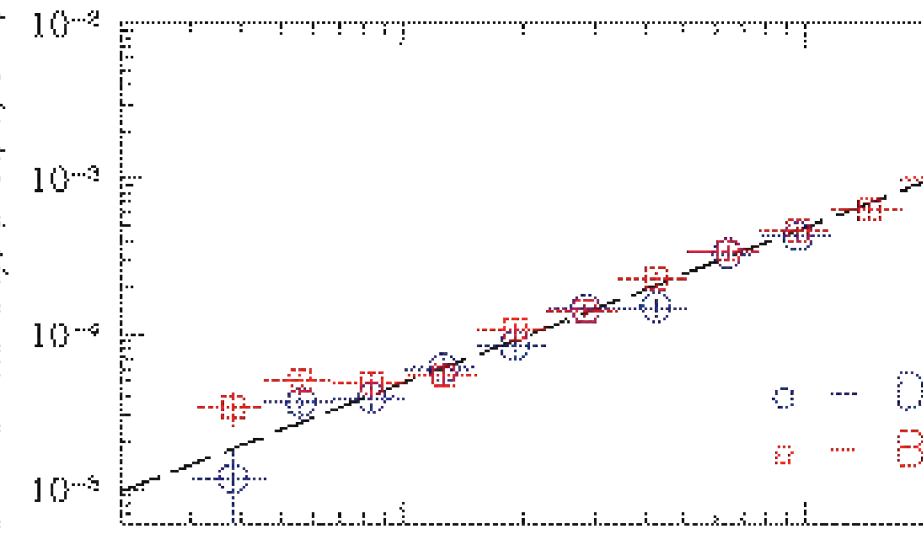
llent Linear Correlation

$$\nu\,[\mathrm{ph\ sec^{-1}\ cm^{-2}\ deg^{-2}}]$$
$$= 4.7 \times 10^{-5} I_{4.9\mu m}[\mathrm{MJy\ str^{-1}}]$$

m comes from stars in the
o.

eV line _ _ Point Source

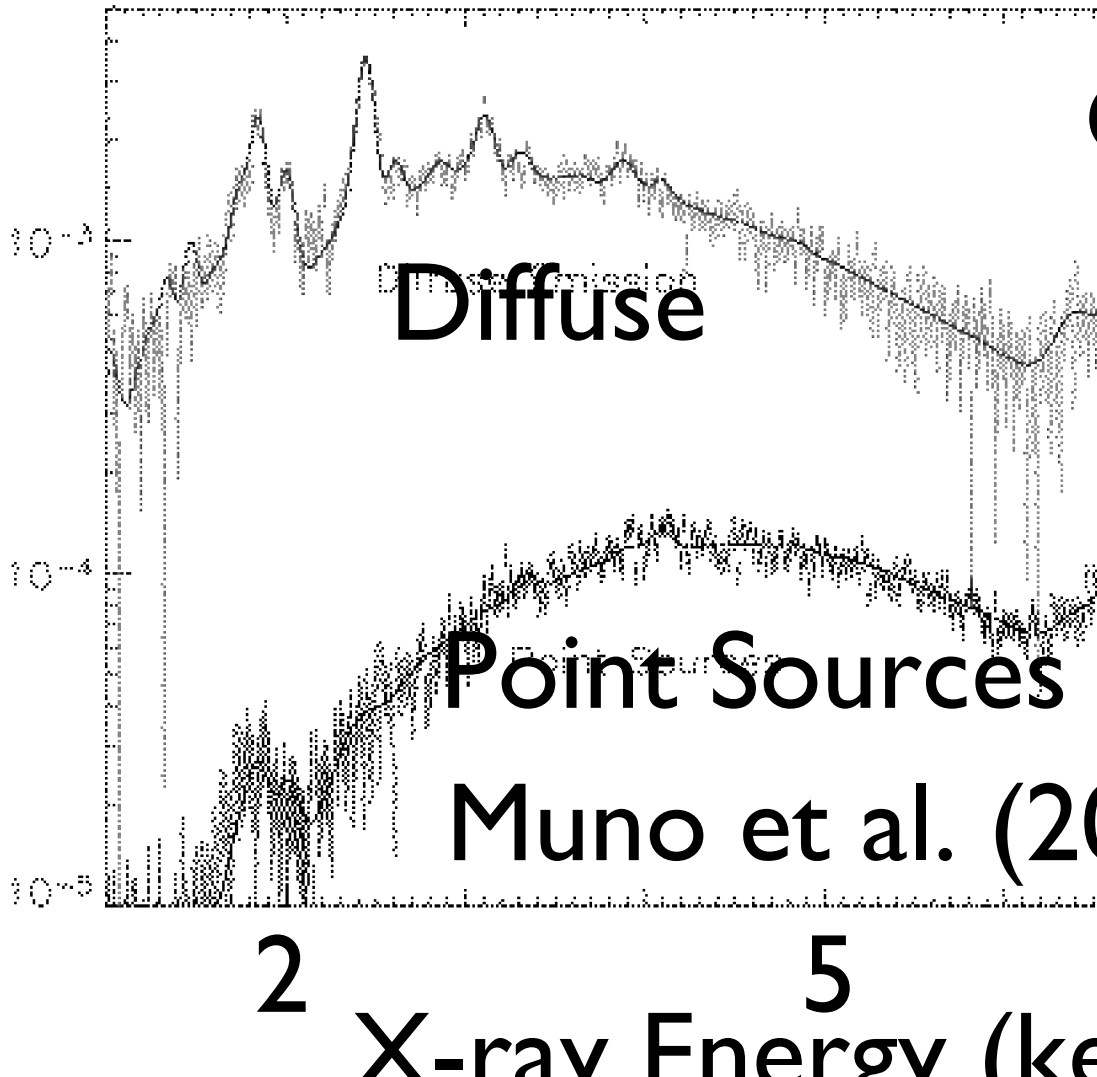




CDX) (Inner 17'×17'= 42pc×42

ctrum of the
onent emitting 6.7-keV
f the "Diffuse Emission"
lar to that of _ Point
es. (Muno+04)

% of the total
on of 4-8keV (r<2-4')
esolved. All of the
se Emission" is likey
ced by weak CV.



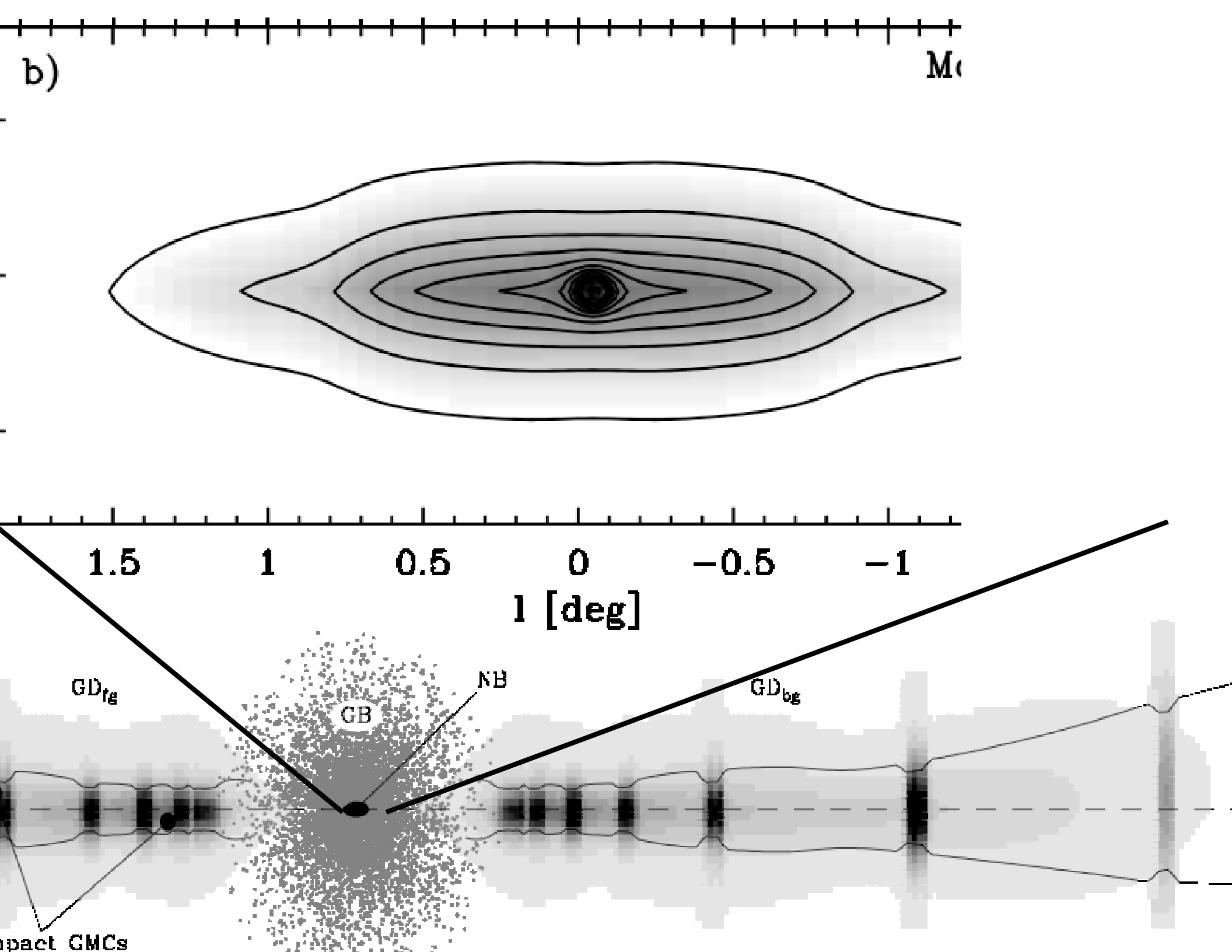
6.7-keV line emission in

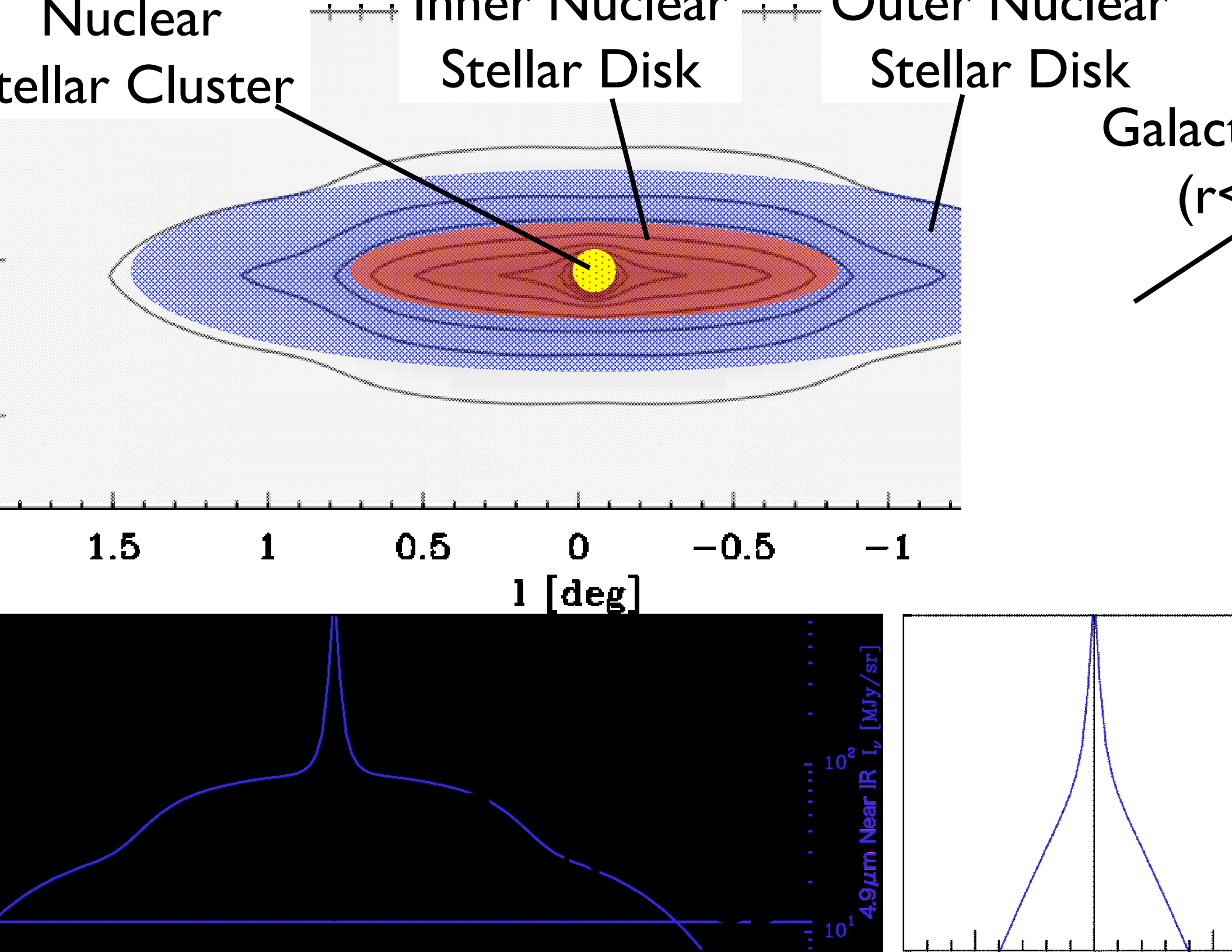
o see the contribution from _ point sources to
CDX, we assume the results on GRXE by
evnivtsev+06 and apply their correlation of

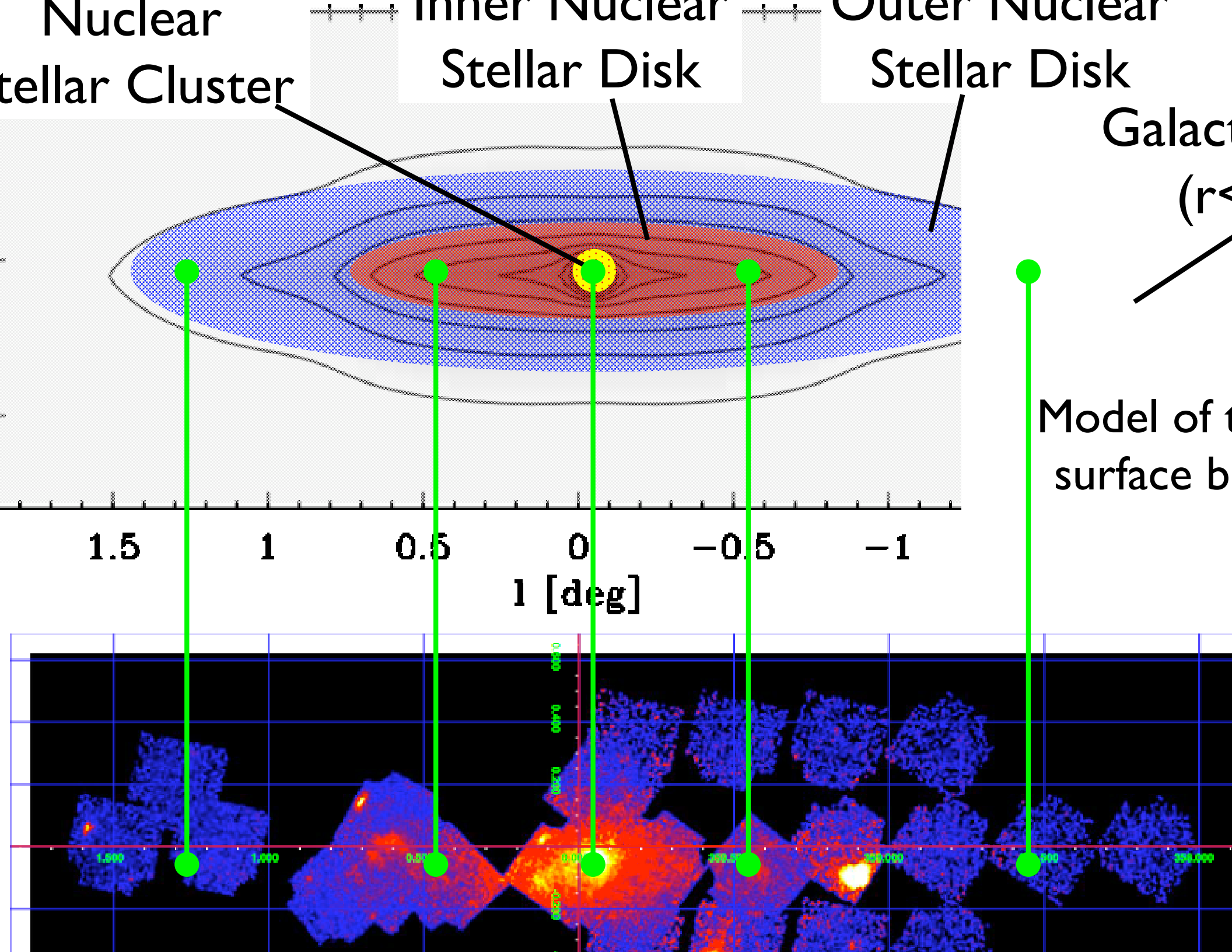
$$I_{6.7keV}[\mathrm{ph\ sec^{-1}\ cm^{-2}\ deg^{-2}}]$$
$$= 4.7 \times 10^{-5} I_{4.9\mu m}[\mathrm{MJy\ str^{-}}$$

the GC region.

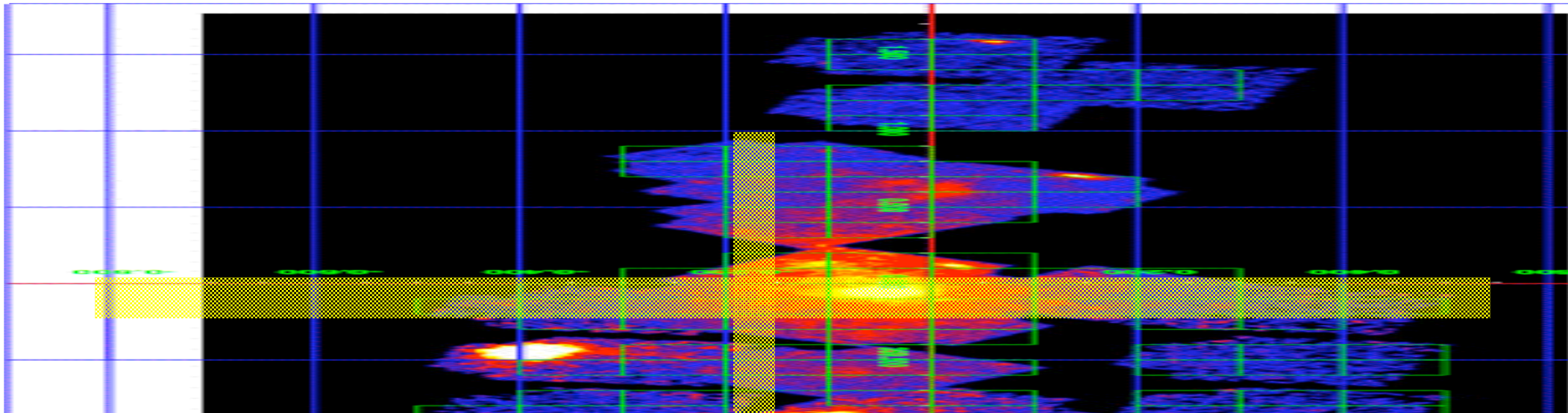
hen, we see what happens.

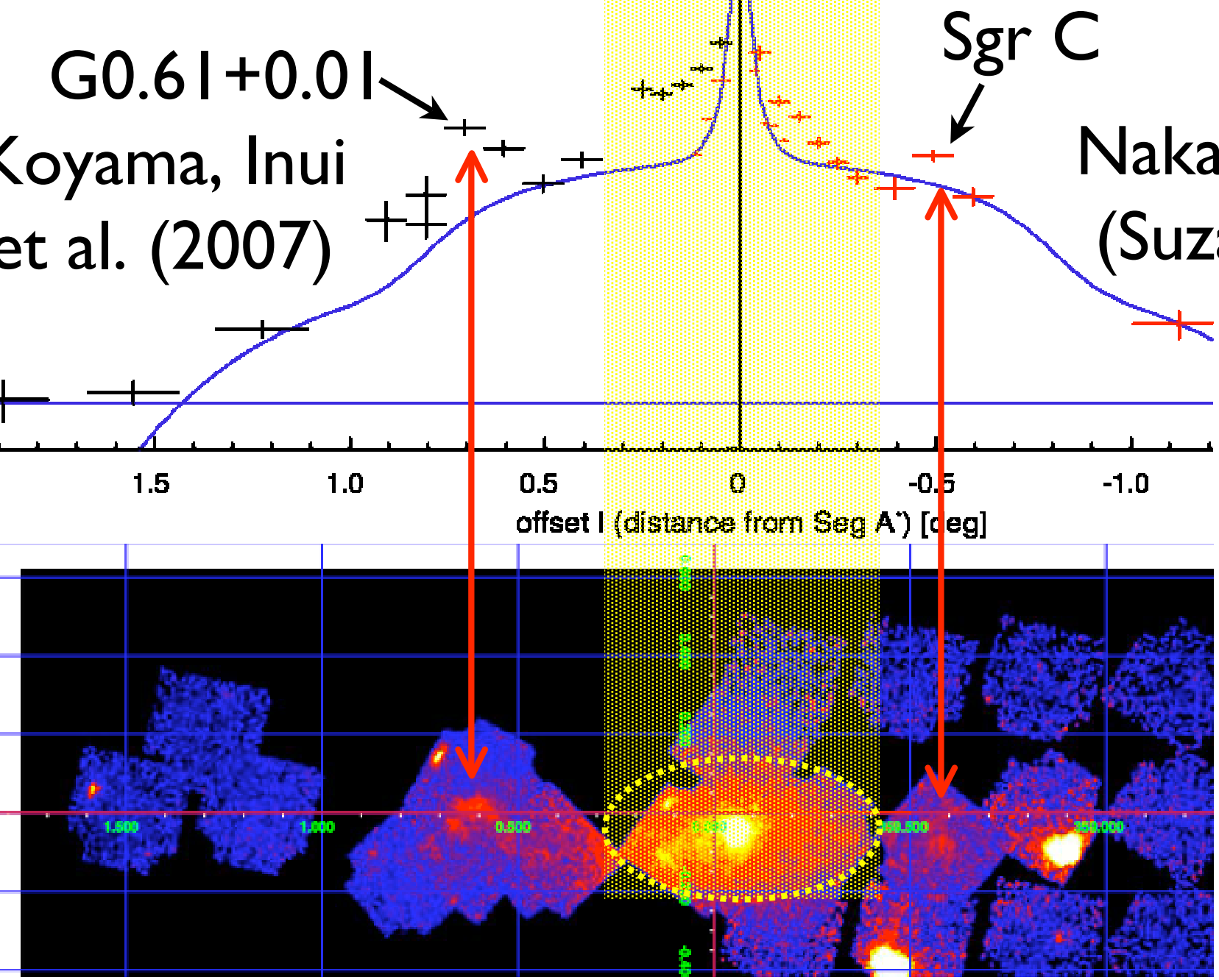

b)
M
1.5
1
0.5
0
−0.5
−1
l [deg]
GD$_{fg}$
NB
GB
GD$_{bg}$
pact GMCs


Nuclear
tellar Cluster
Inner Nuclear
Stellar Disk
Outer Nuclear
Stellar Disk
Galact
(r<
1.5
1
0.5
0
−0.5
−1
l [deg]
10^2
10^1
4.9μm Near IR I_ν [MJy/sr]


Nuclear
tellar Cluster
Inner Nuclear
Stellar Disk
Outer Nuclear
Stellar Disk
Galact
(r<
Model of t
surface b
1.5
1
0.5
0
−0.5
−1
l [deg]

- Fitting the spectrum of each region along the galactic longitude (Nobukawa) and latitude (Hyodo).
- See Nobukawa et al. (Poster B44) for details and 2D fittings.





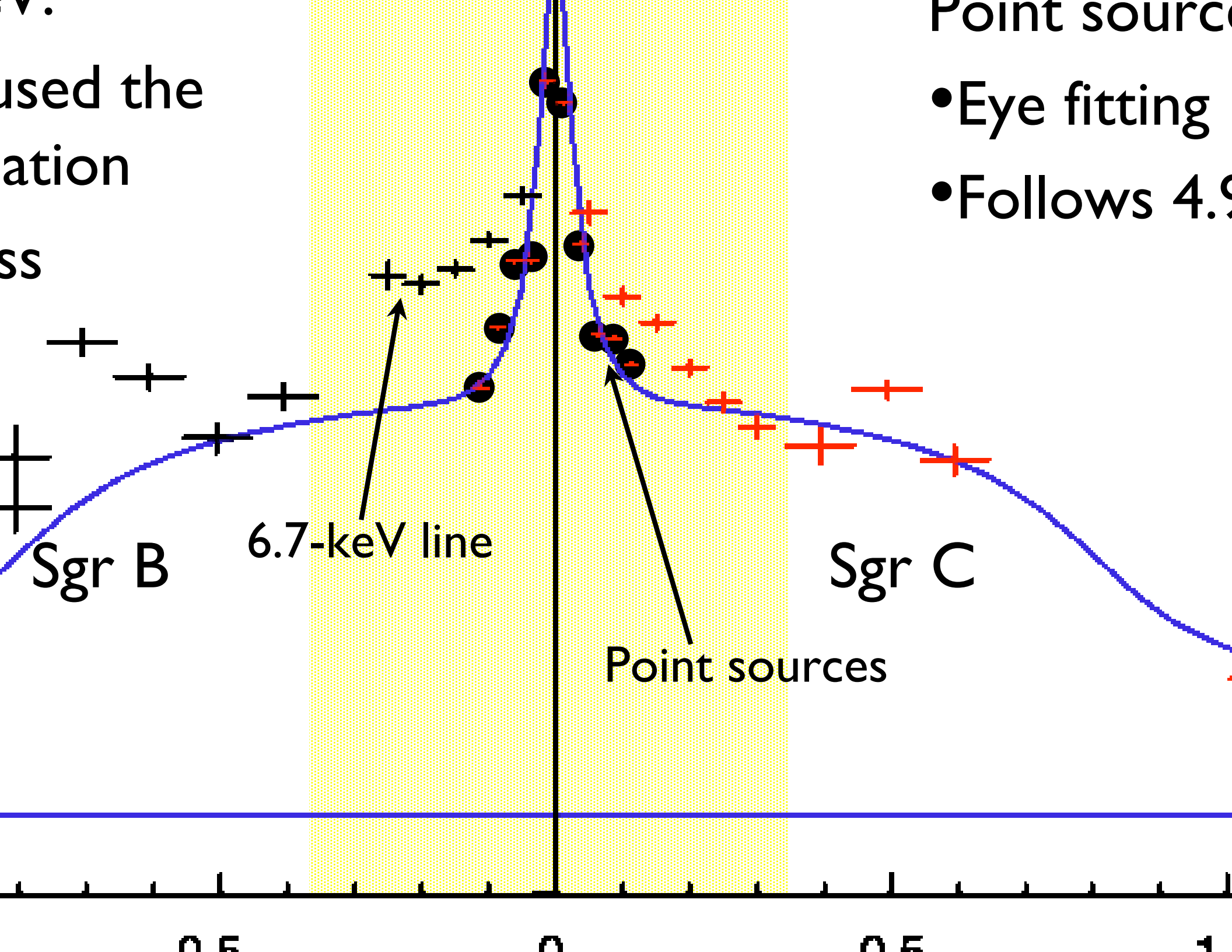
°: 6.7-keV follows NIR (except for individual S

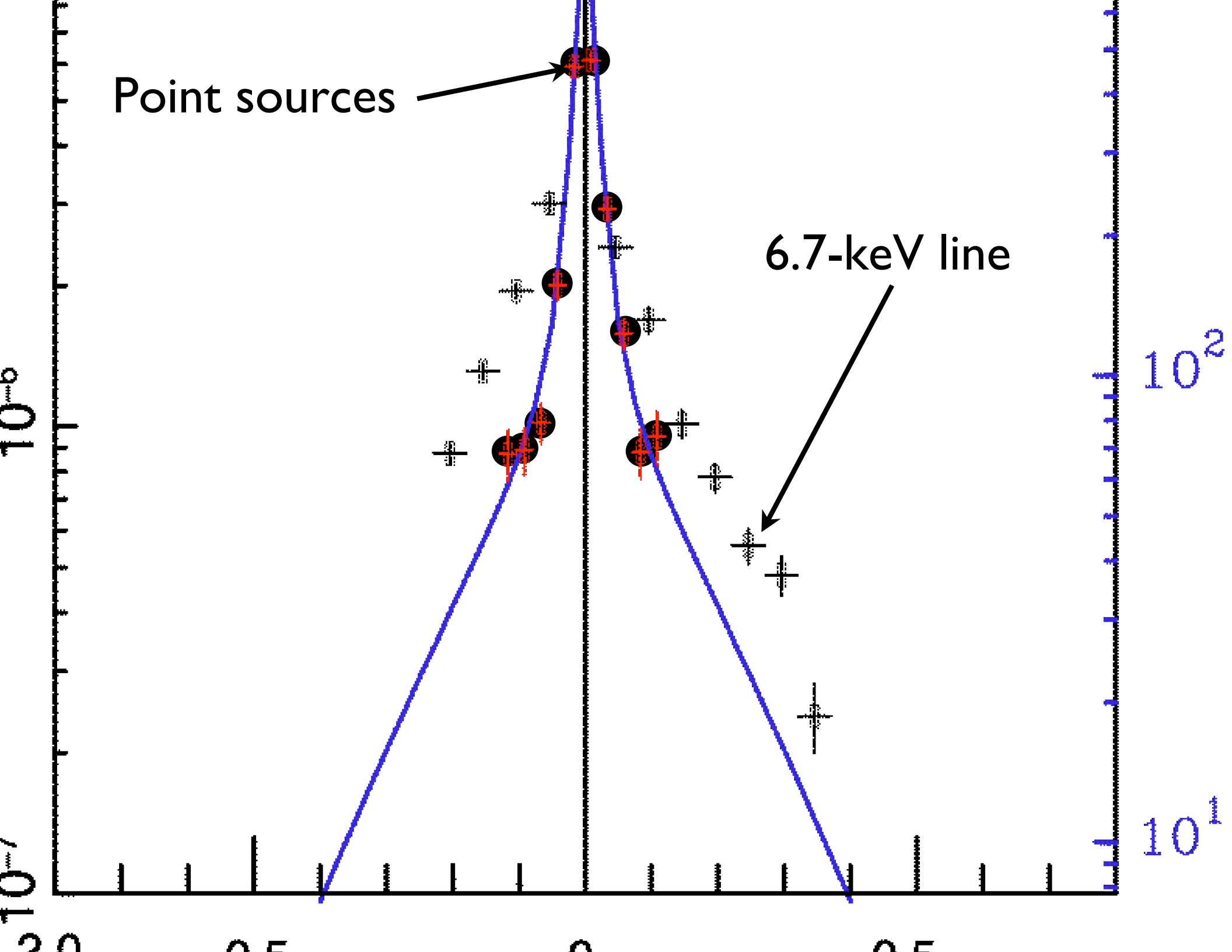
V.

used the
ation
ss

Point source

- Eye fitting
- Follows 4.9




Point sources
6.7-keV line
10^{-6}
10^{-7}
10^{2}
10^{1}

sults

suming the results of Revnivtsev+06, then we f

icant excess emission of 6.7-keV line above the

ctation from the 4.9_m surface brightness.

e excess can not be explained by _ point sourc

It suggests:

uly diffuse plasmas emitting 6.7-keV emission li

y exist at the galactic center region.

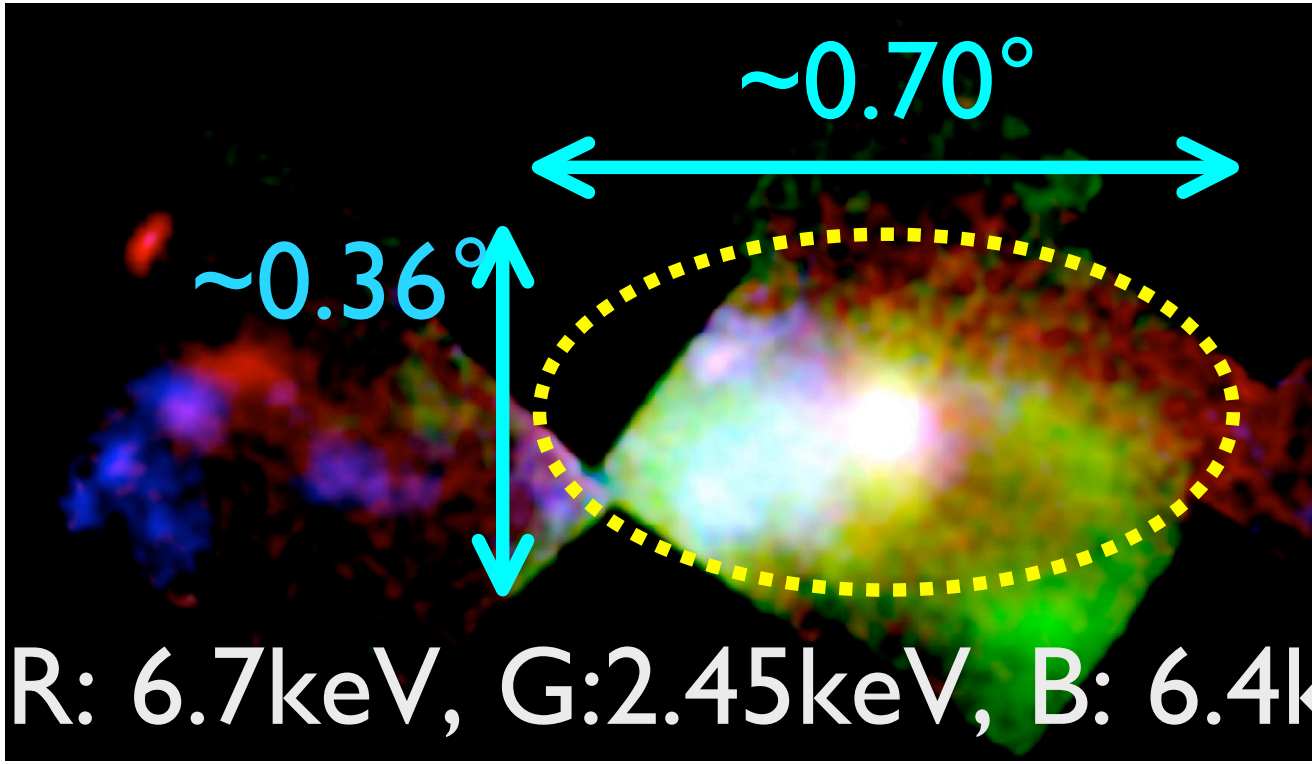
= 52pc x 27pc

= 2×10^{36}ergs/s

~ 0.1cm^{-3}

~ 0.4cm^{-3}

~ 3×10^{52}ergs



e Time scale (latutude) τ_{esc} = Size/Cs = 2_10^4y

ng Rate = E_{gas}/τ_{esc} ~ 5_10^{40}ergs/s ~ 10^{-3} SN yr

gher than the current activity of Sgr A* and ~1

ected from the stellar mass in this region.

a is in the ionization equilibrium or(not Koyama

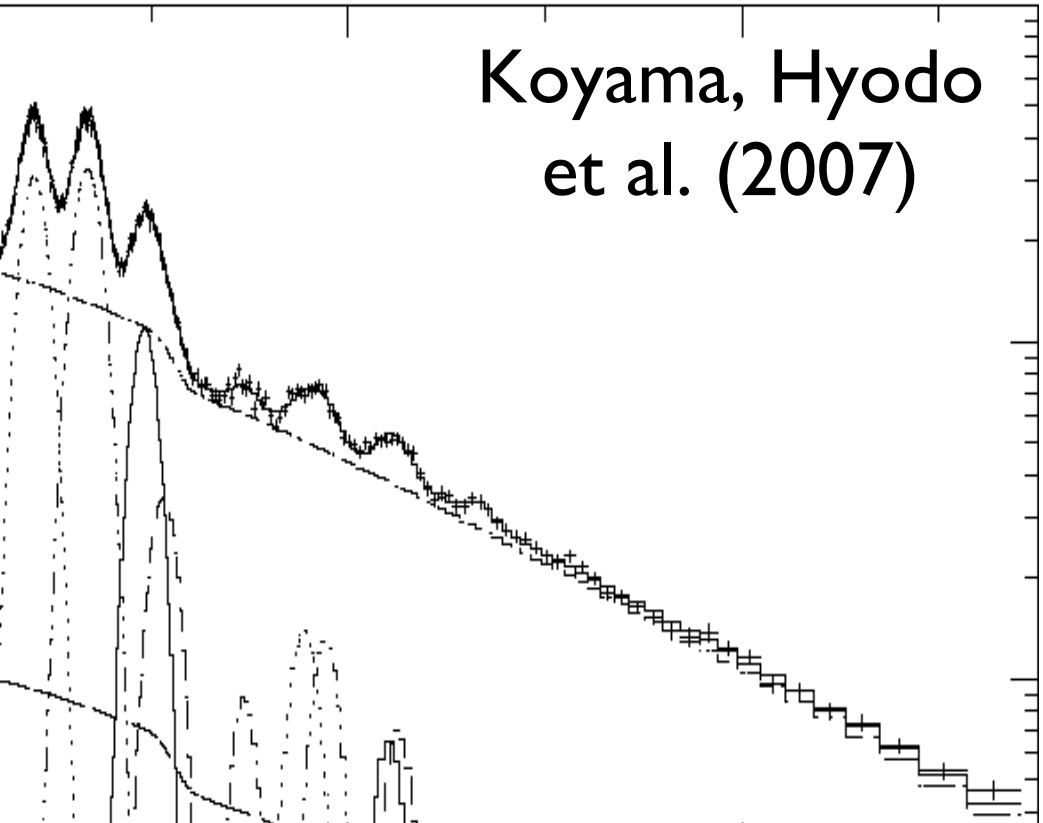
stimation

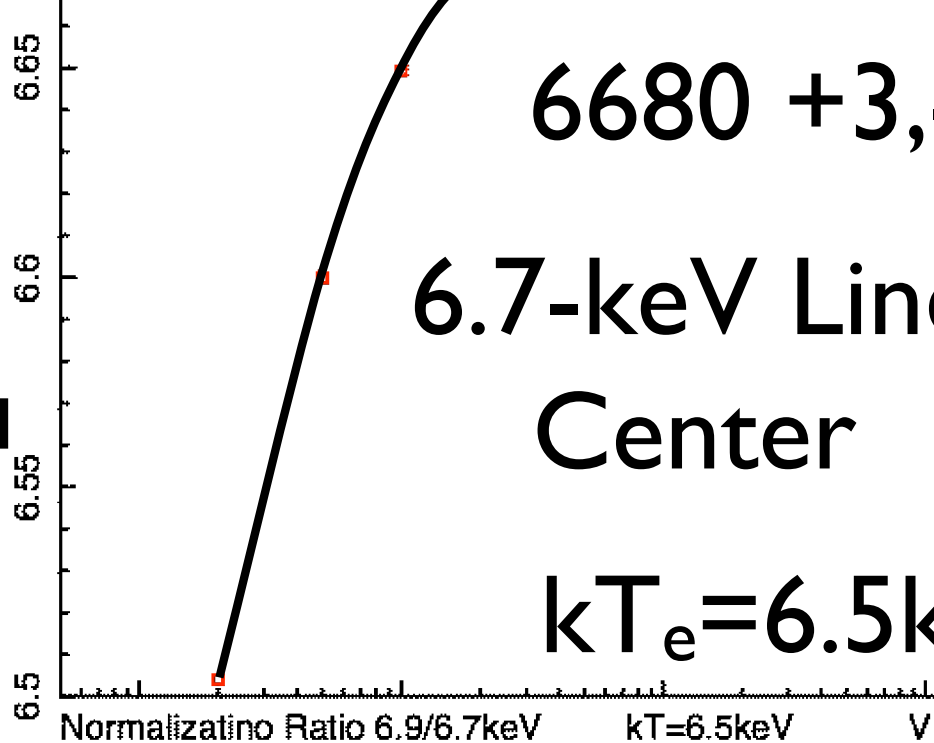
$n_{esc} \sim 1 \times 10^{11}$ sec cm^{-3}

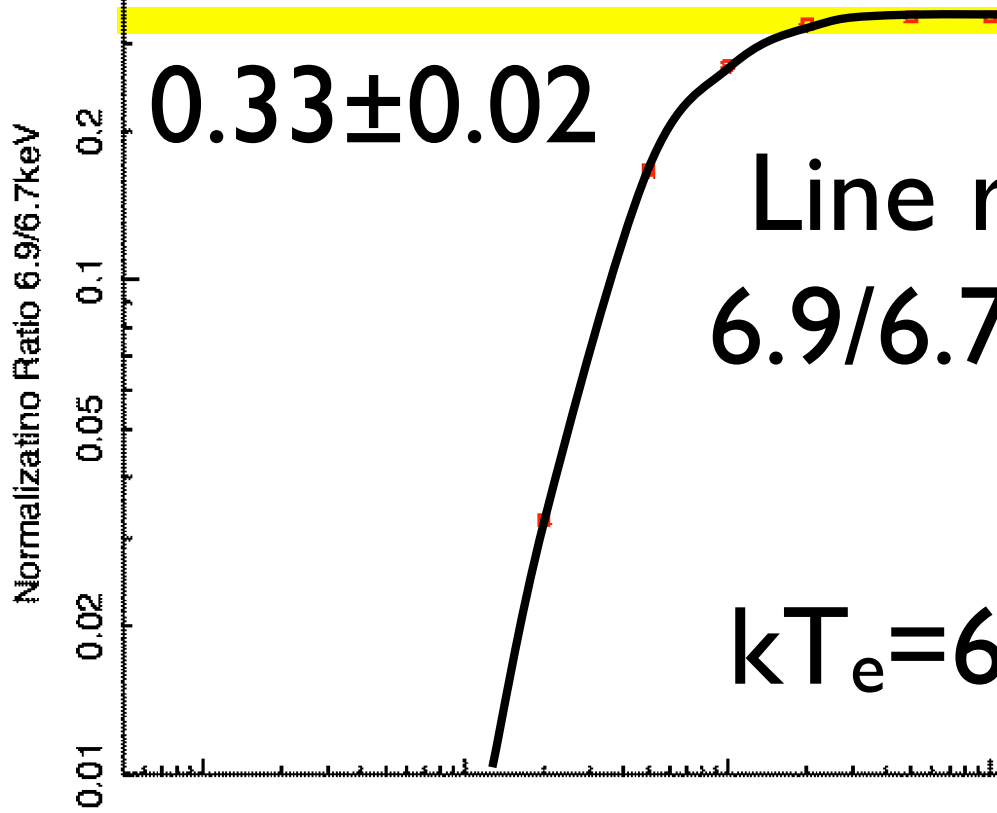
consistent with the Suzaku

trum

$> 2\_10^{12}$ sec cm^{-3}







ssure

(eg. Yamauchi+90, Koyam

= 0.1mG~1mG

$_B/k = 10^6$-10^8 K/cm^3 ~ $P_{gas}/k = 2\times10^7$ K/cm^3

he strength of the magnetic field can confine 6.7keV

lasma.

low diffusion _ Makes the required heating rate low

ut, the orientation of the mag. is vertical against the

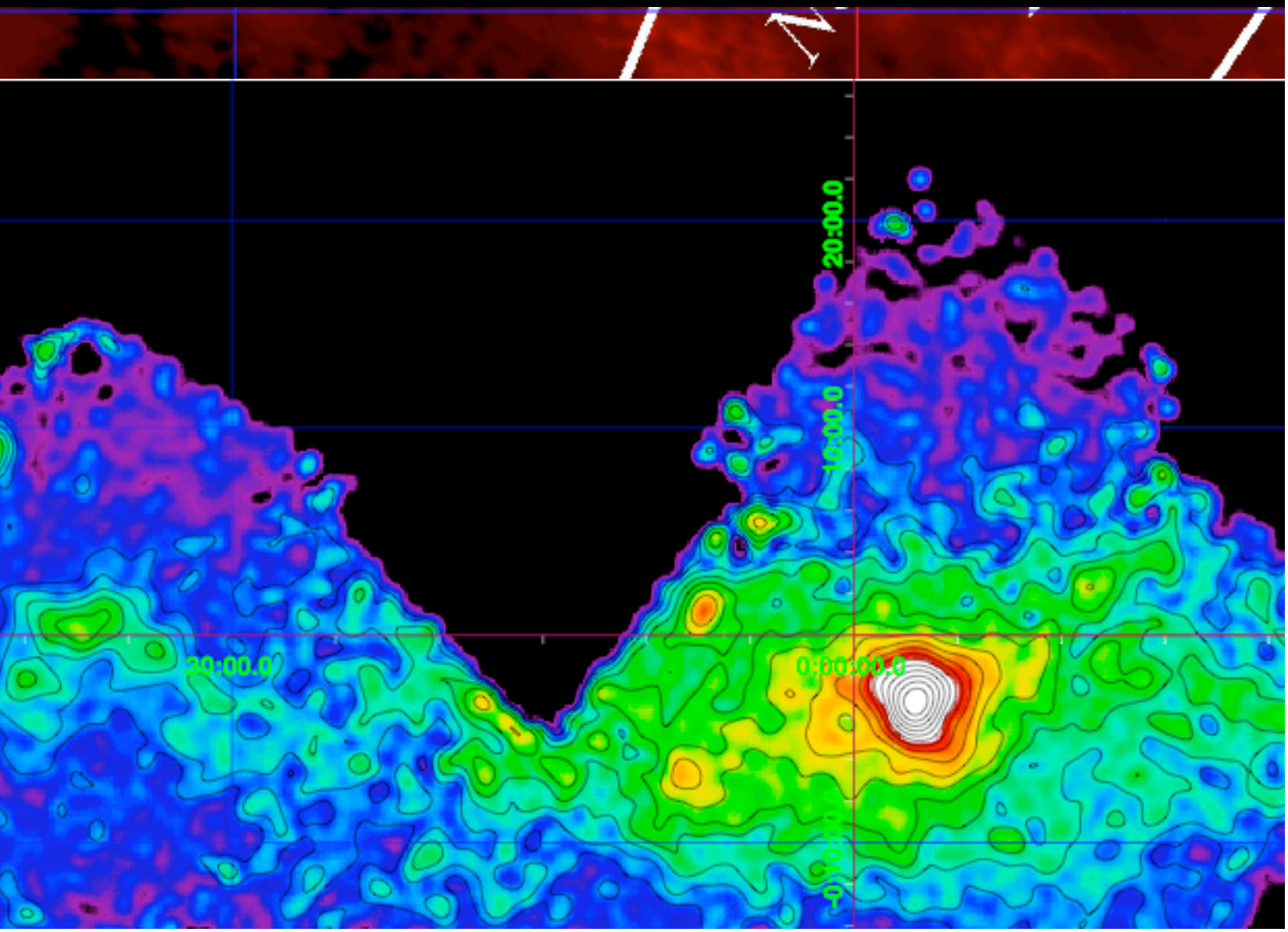
Easy to escape.

ge

ynchrotron radio : Filamentary structures exist.

.7-keV : Looks smooth.

Is there any correlation



ssure

(eg. Yamauchi+90, Koyam

= 0.1mG~1mG

$_B/k = 10^6$-10^8 K/cm^3 ~ $P_{gas}/k = 2 \times 10^7$ K/cm^3

he strength of the magnetic field can confine 6.7keV

lasma.

low diffusion _ Makes the required heating rate low

ut, the orientation of the mag. is vertical against the

Easy to escape.

ge

ynchrotron radio : Filamentary structures exist.

.7-keV : Looks smooth.

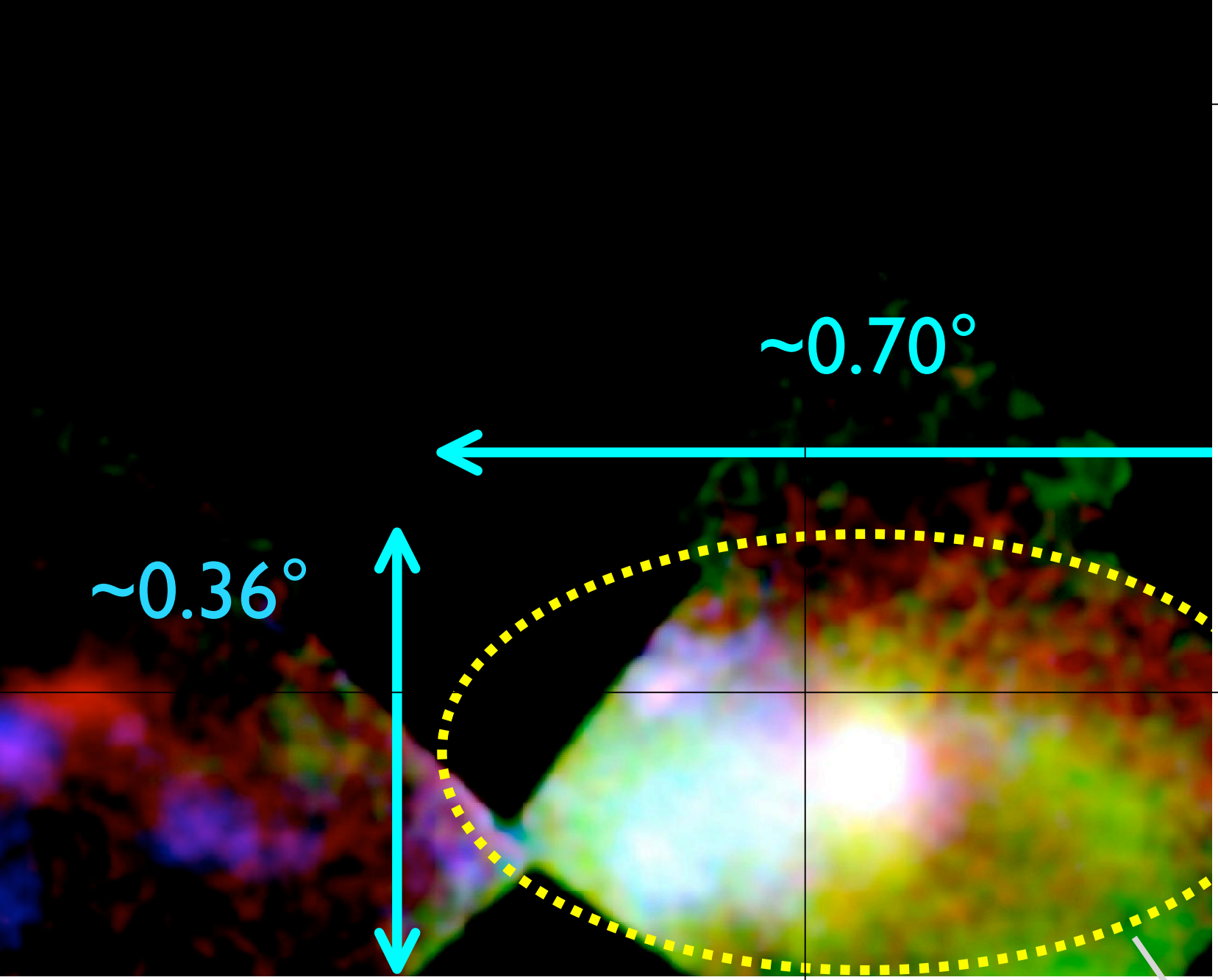
feel it is difficult to conclude something at this mom

Heat source

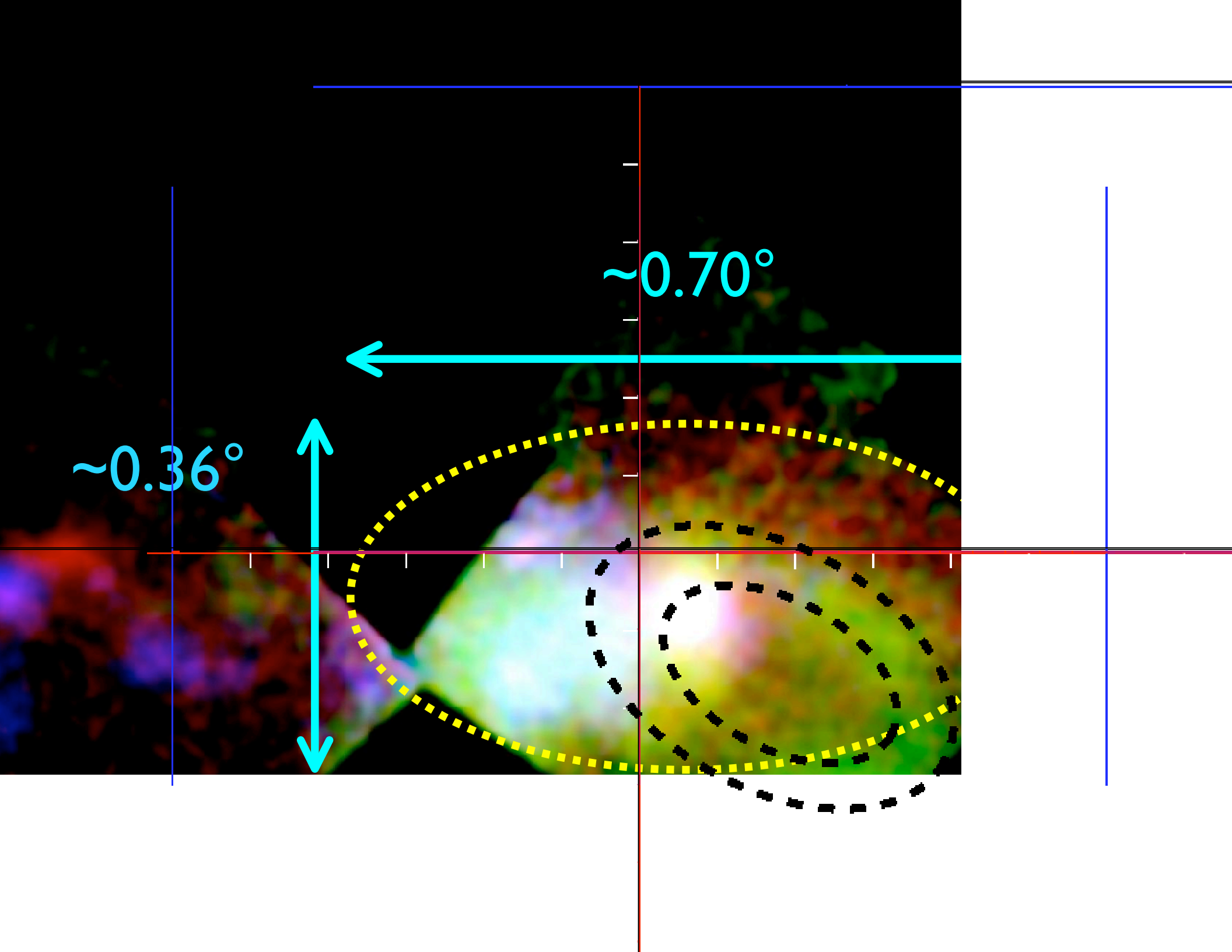
Candidates for the heat source

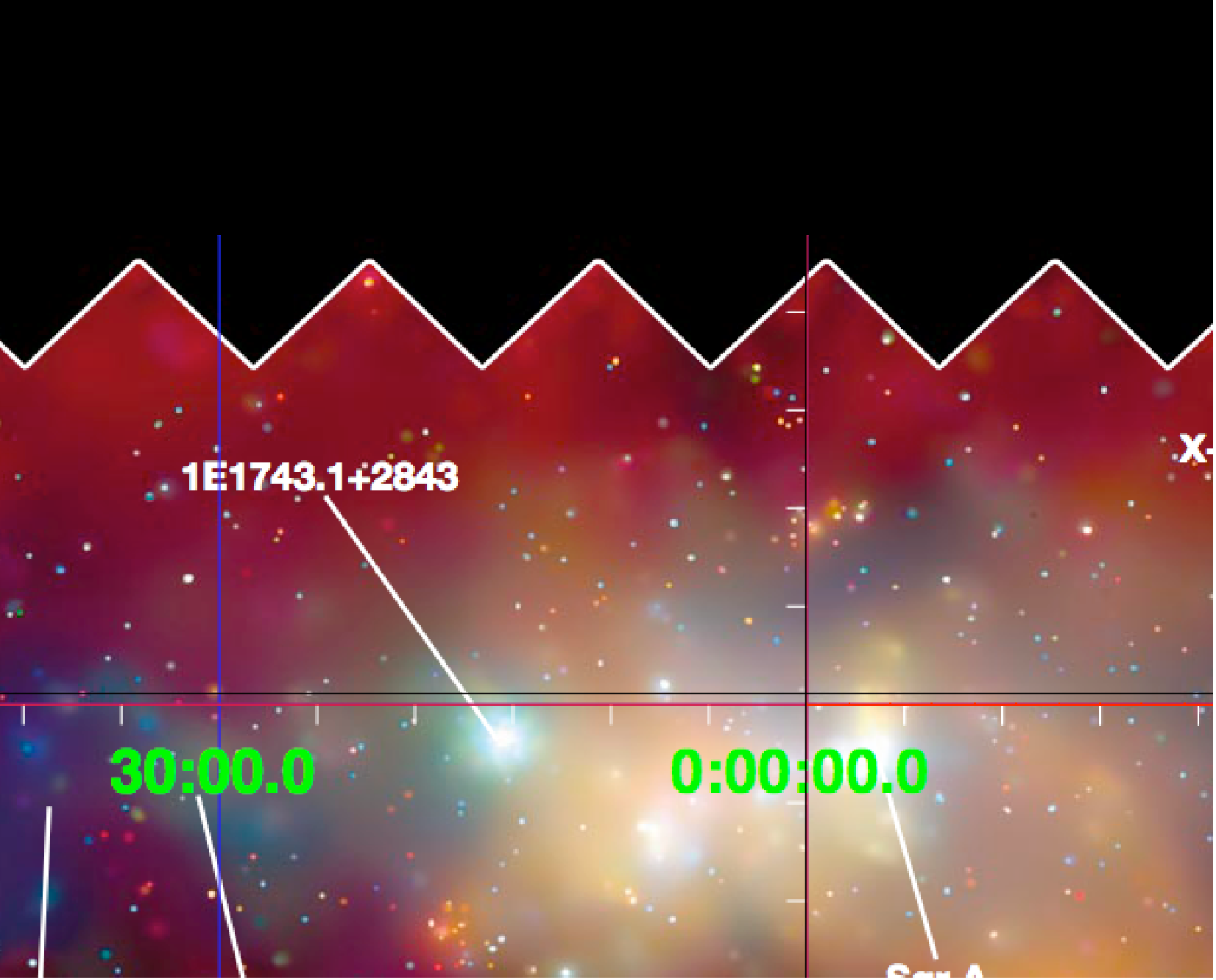
- Sequential supernovae (mini starburst)
- Jet from Sgr A*
- Reconnection of Magnetic fields
- ...

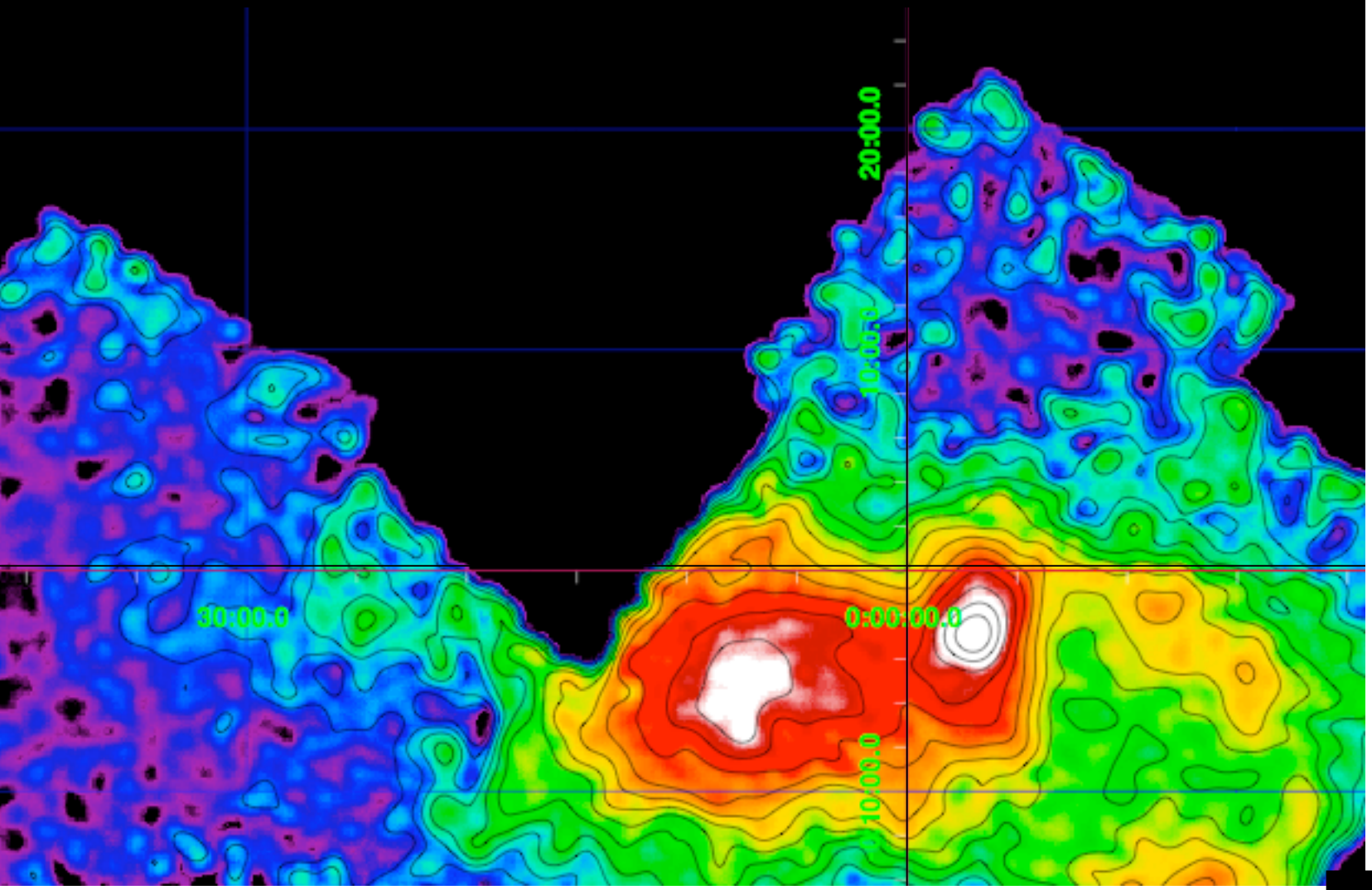
Let's look at Suzaku image to search for a hint



The region of the exces


~0.70°
~0.36°

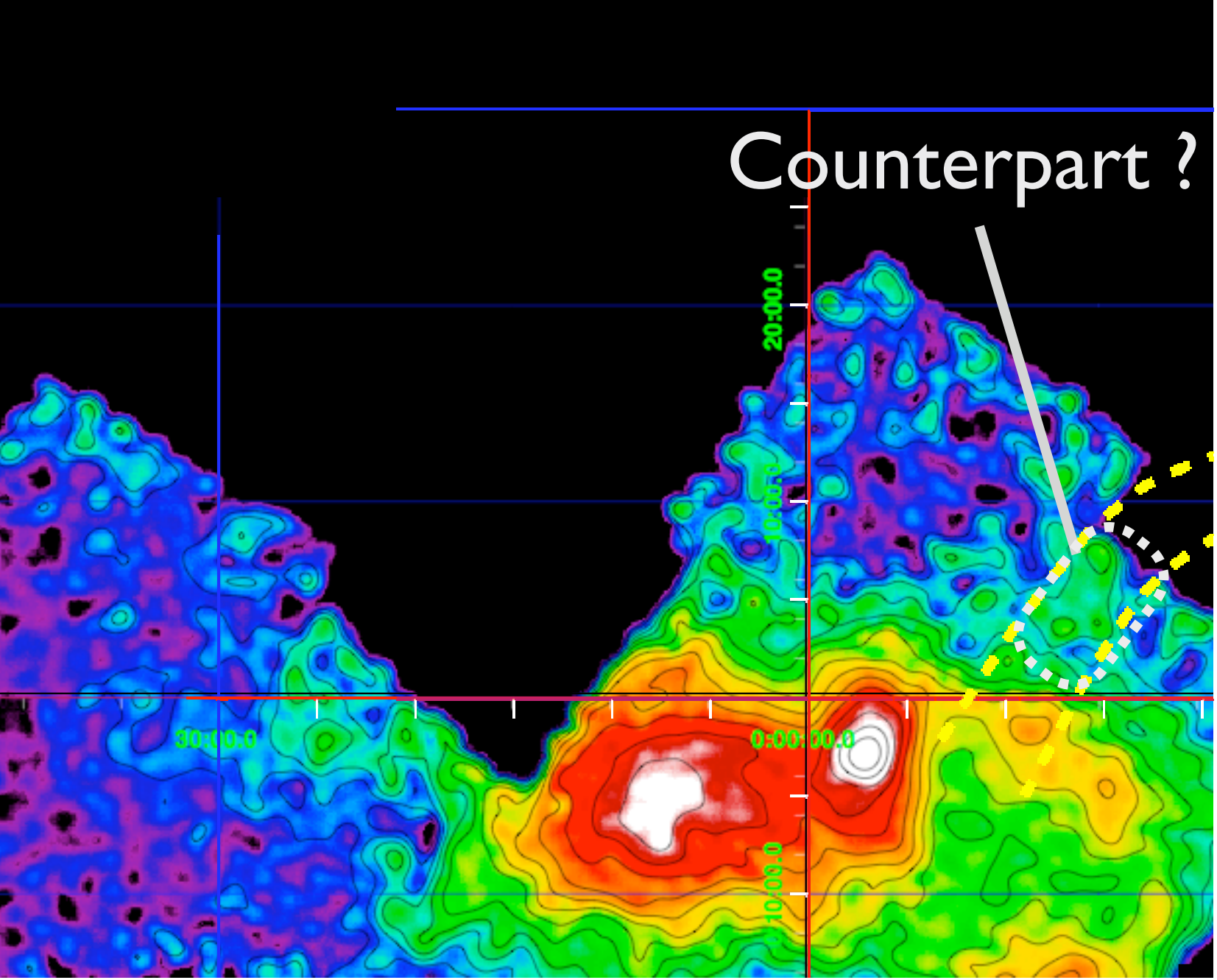

1E1743.1+2843
30:00.0
0:00:00.0

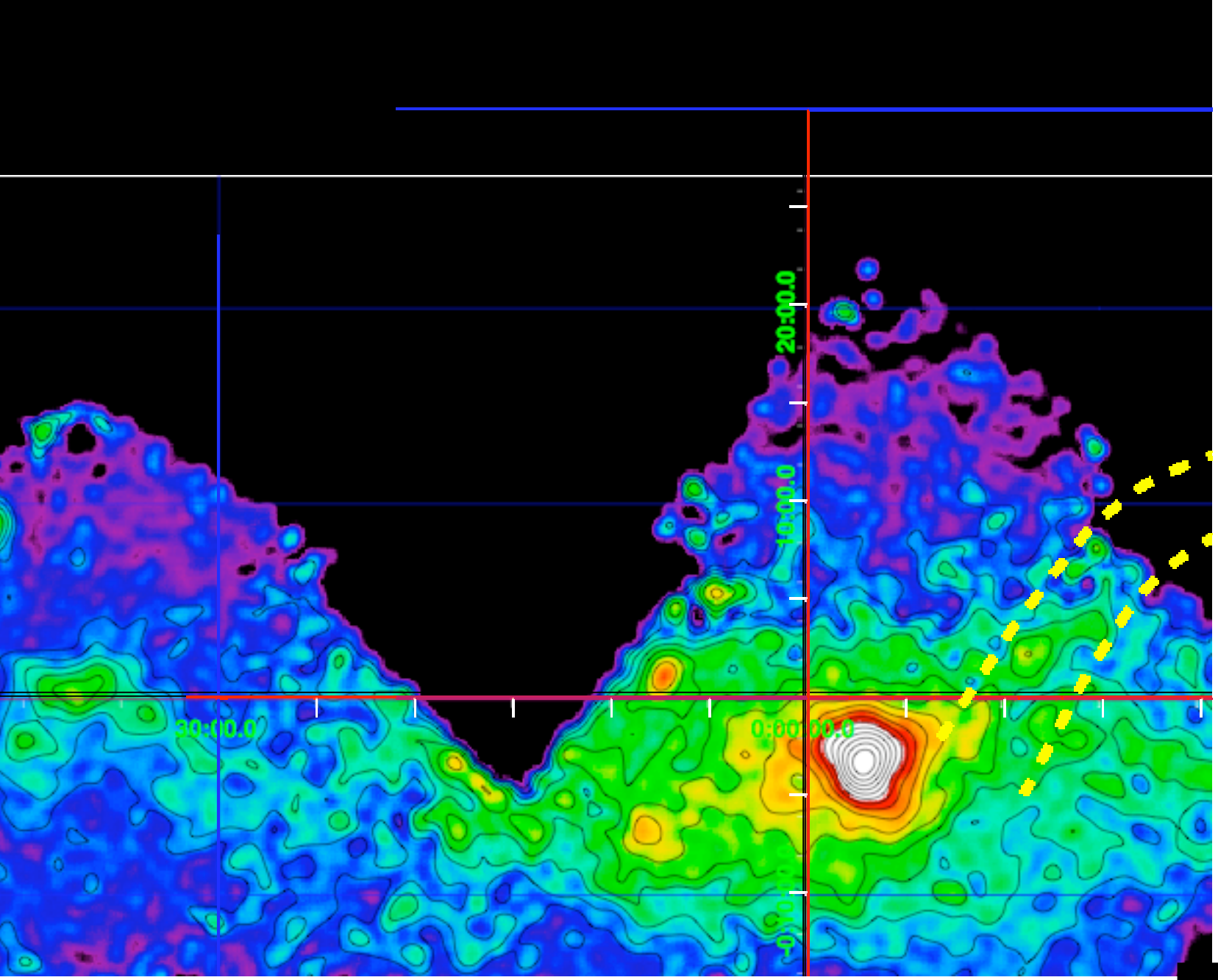


~3_10

Mo

G359.73-0.


Counterpart ?
20:00.0
10:00.0
30:00.0
0:00:00.0
10:00.0


20:00.0
10:00.0
30:00.0
0:00:00.0

Heat source

Candidates for the heat source

- Sequential supernovae (mini starburst)
- Jet from Sgr A*
- Reconnection of Magnetic fields
- ...

Let's look at Suzaku image to search for a hint

- We found candidates for superbubbles.

Conclusion

Significant excess emission of 6.7-keV above th
point sources expected from NIR.

Suggests the existence of truly diffuse X-ray
emission kT=6-7keV in the GC region.

Ionization parameter, heating rate are problem

Confinement by magnetic field ?

Candidates for superbubbles.

Thank you.