MULTIFREQUENCY VLBA OBSERVATIONS OF TWO COMPACT SYMMETRIC OBJECTS:

0108+388
and
J1944+5448

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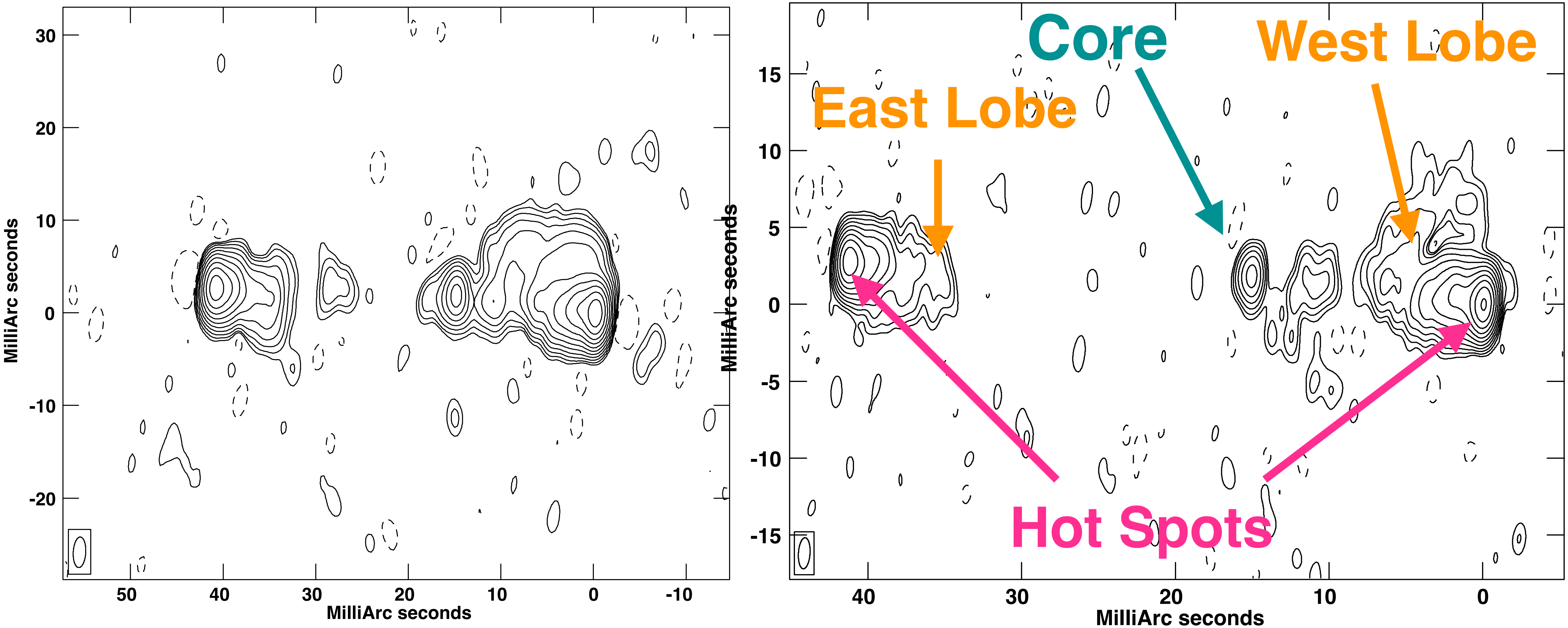
OUTLINE

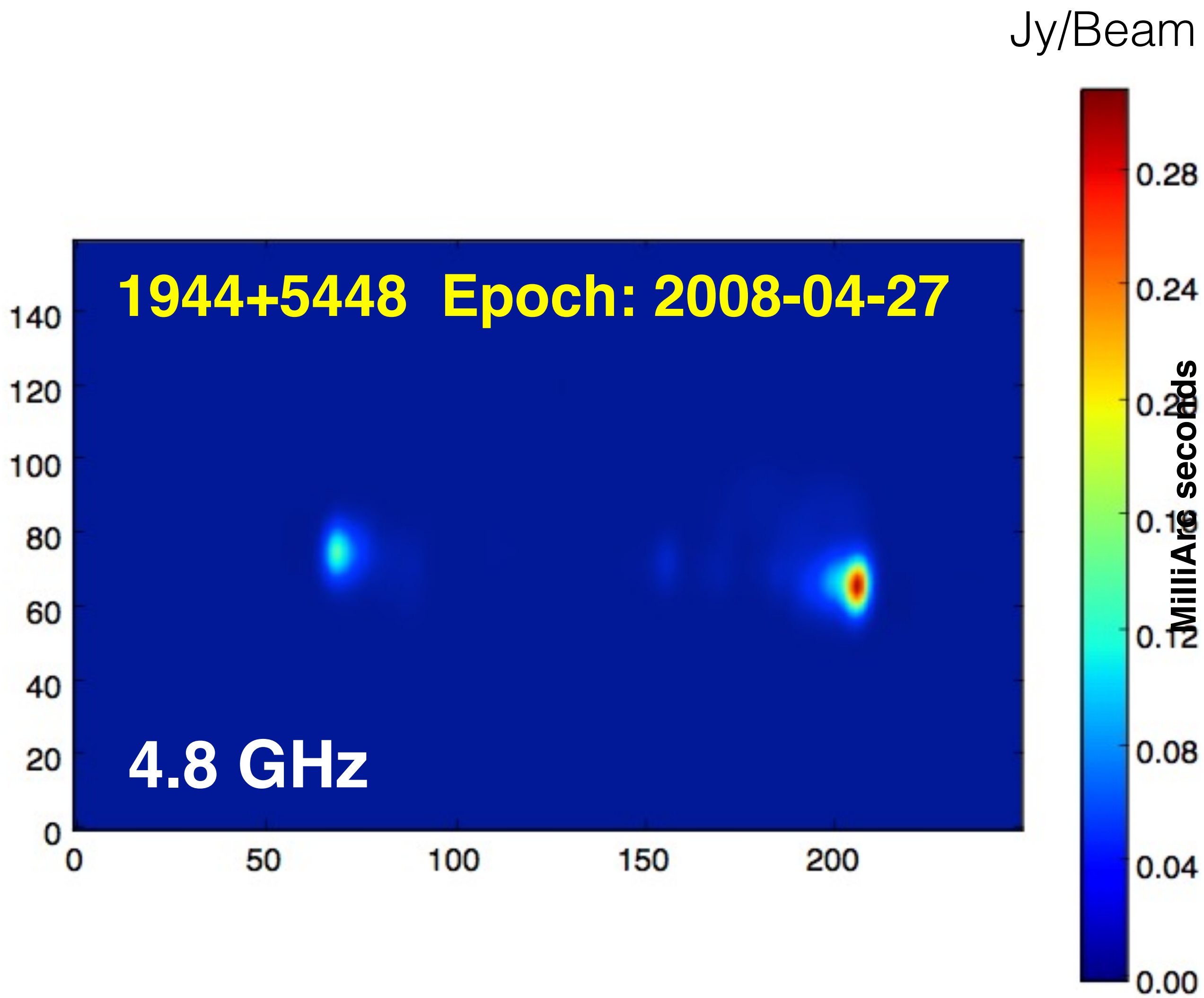
- Morphological properties of 1944+5448 and 0108+388
- Some useful physical parameters
- Hot spots advance speed
- Age
- Spectrum of 0108+388

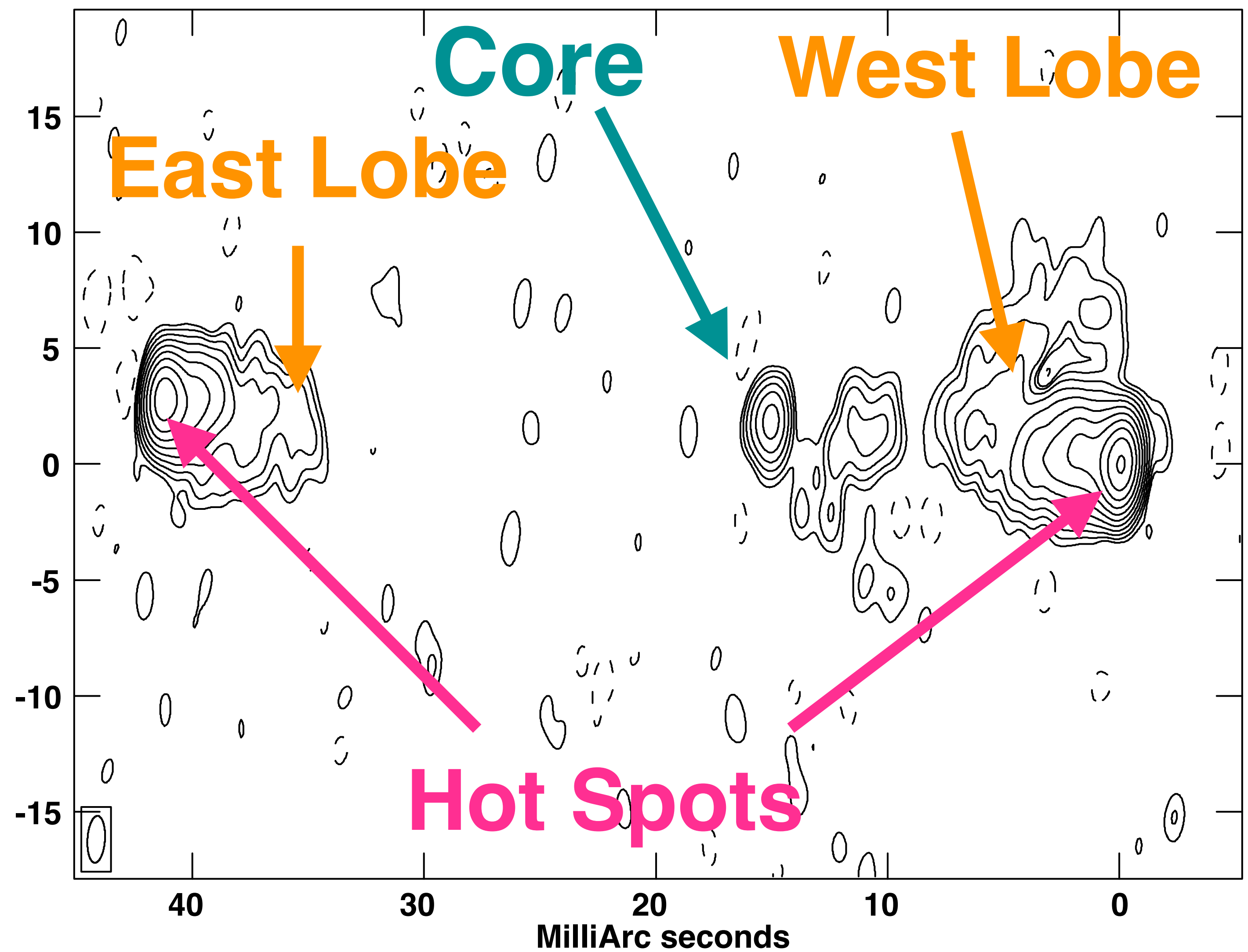
J1944+5448



C Band 4.88 GHz **X Band 8.48 GHz**

J1944+5448





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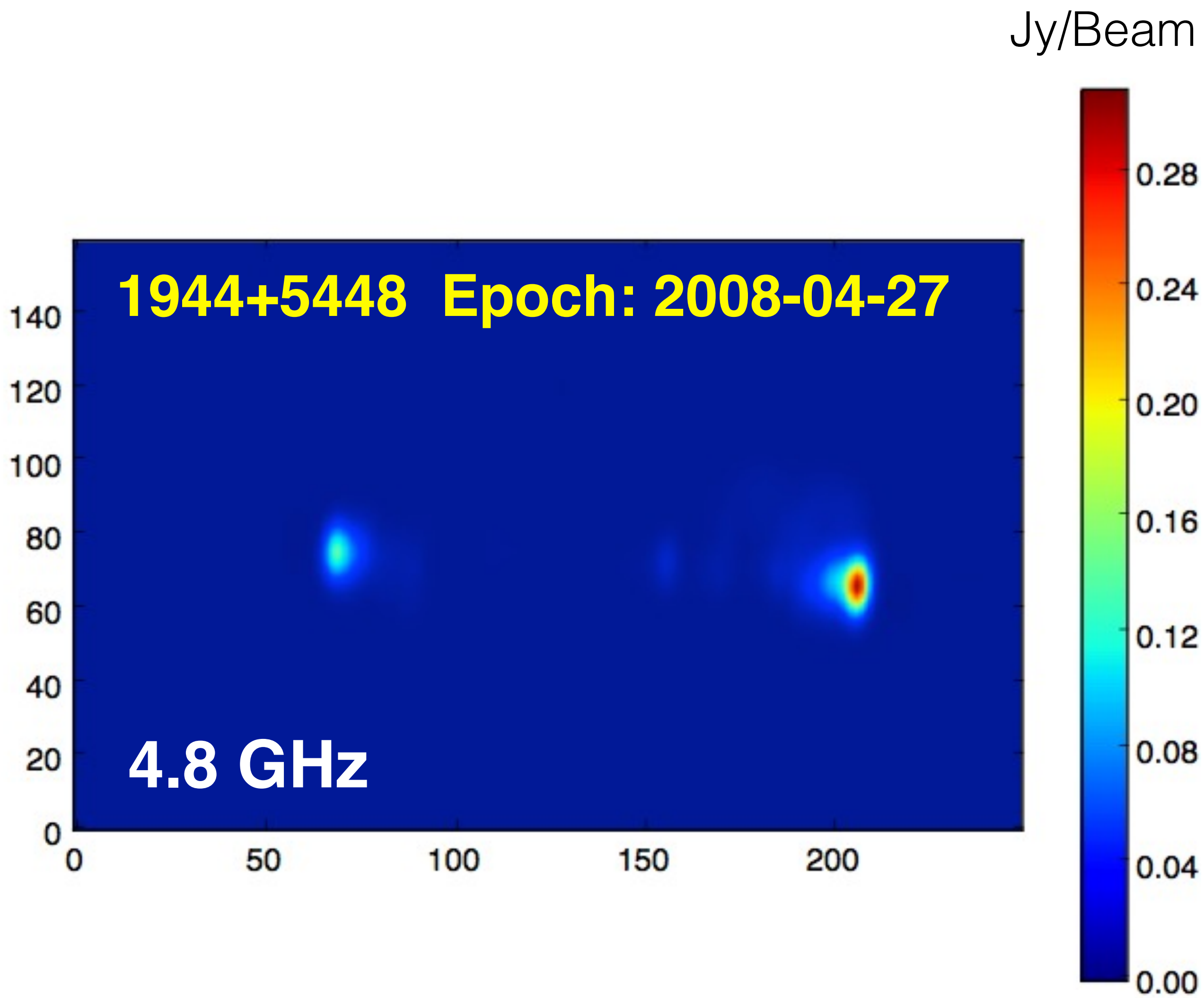


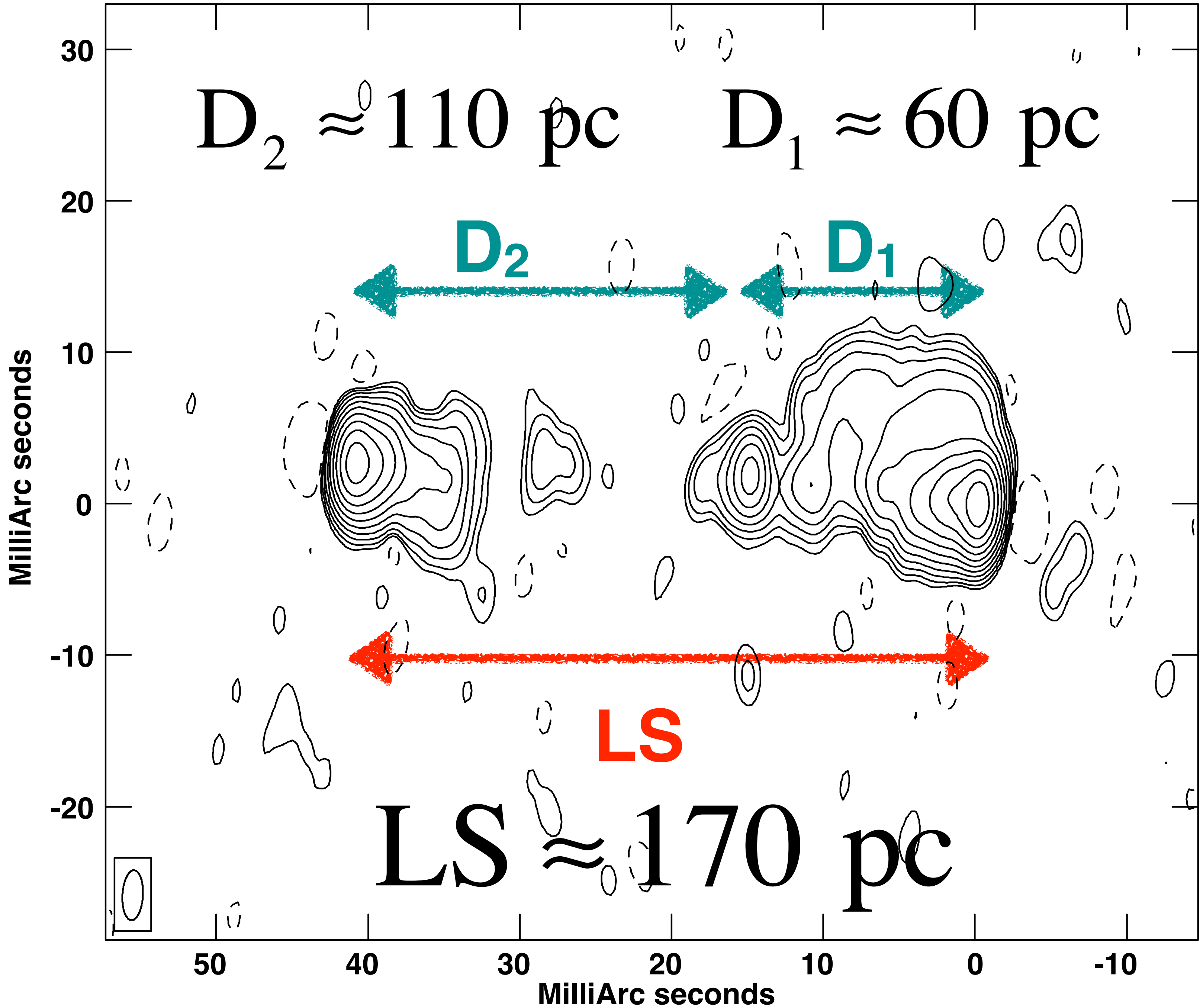
Fluxes Ratio:

Hot Spot $\frac{F_W}{F_E} \geq 3$

Hot Spot /Lobe $\frac{F_W}{F_W} \approx 3$

Hot Spot /Core $\frac{F_W}{F_C} \approx 22$

J1944+5448



$$\text{arm length ratio} = \frac{D_2}{D_1} \approx 2$$

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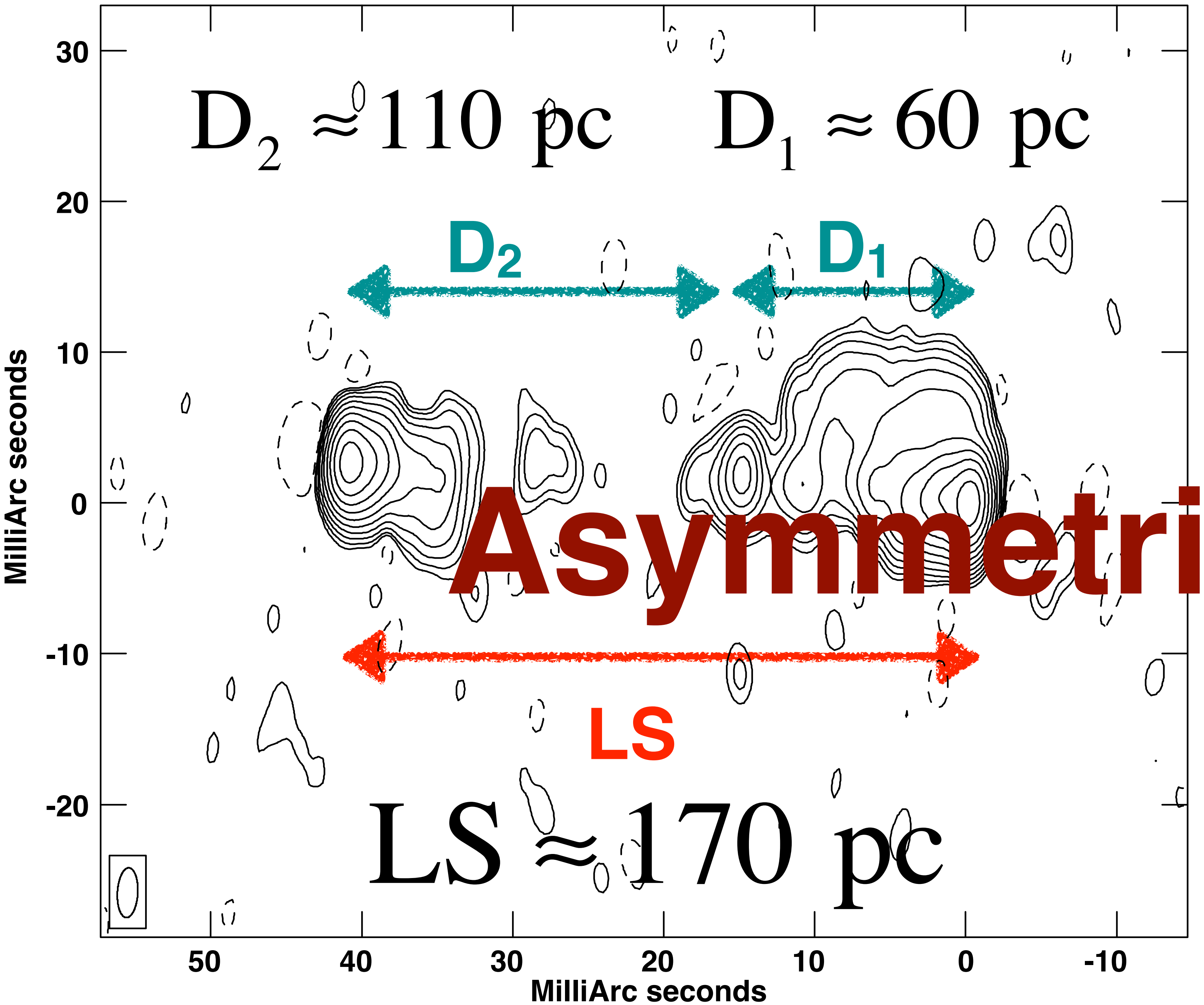


$D_2 \approx 110$ pc $\quad D_1 \approx 60$ pc

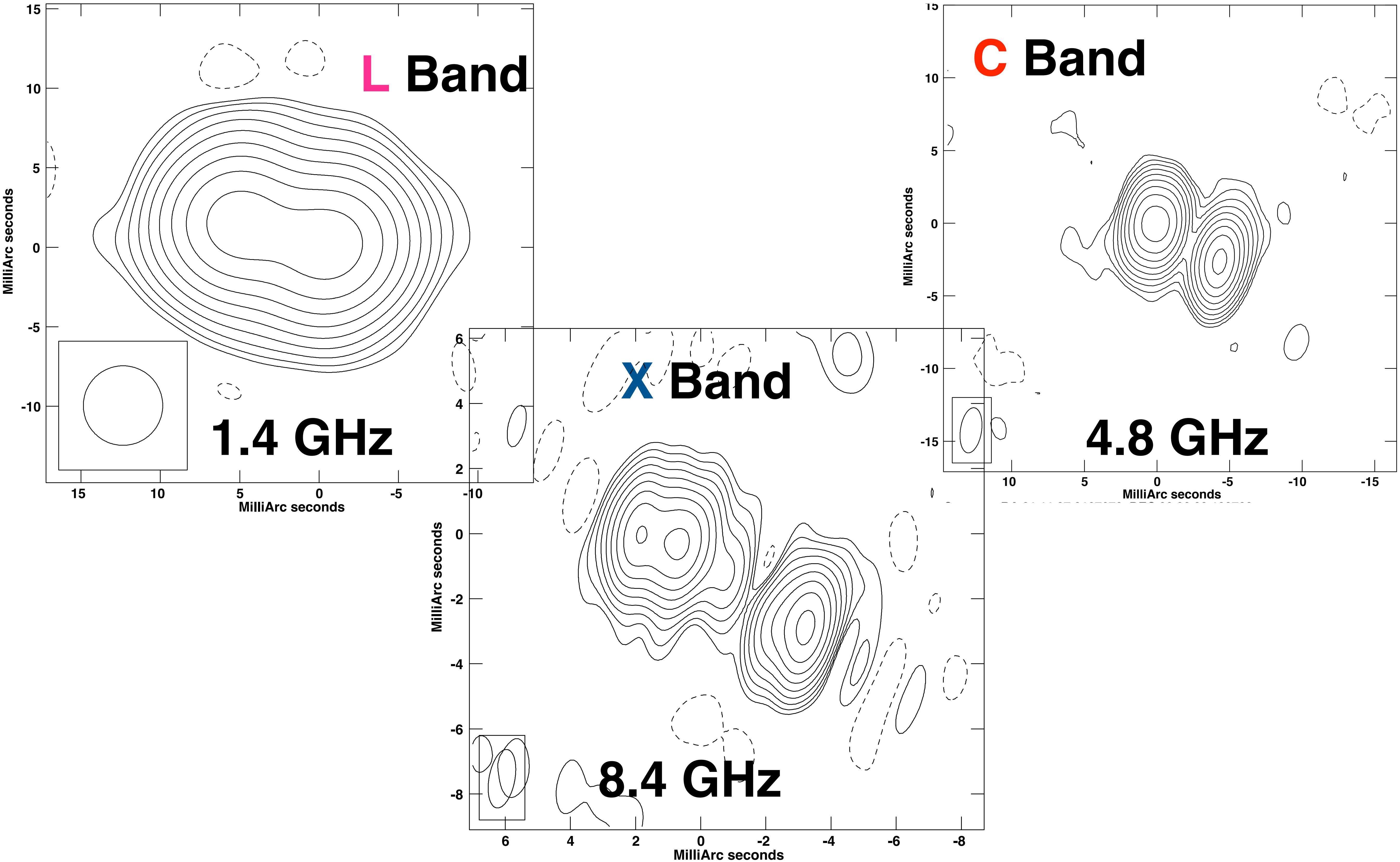
$LS \approx 170$ pc

Asymmetric source!!

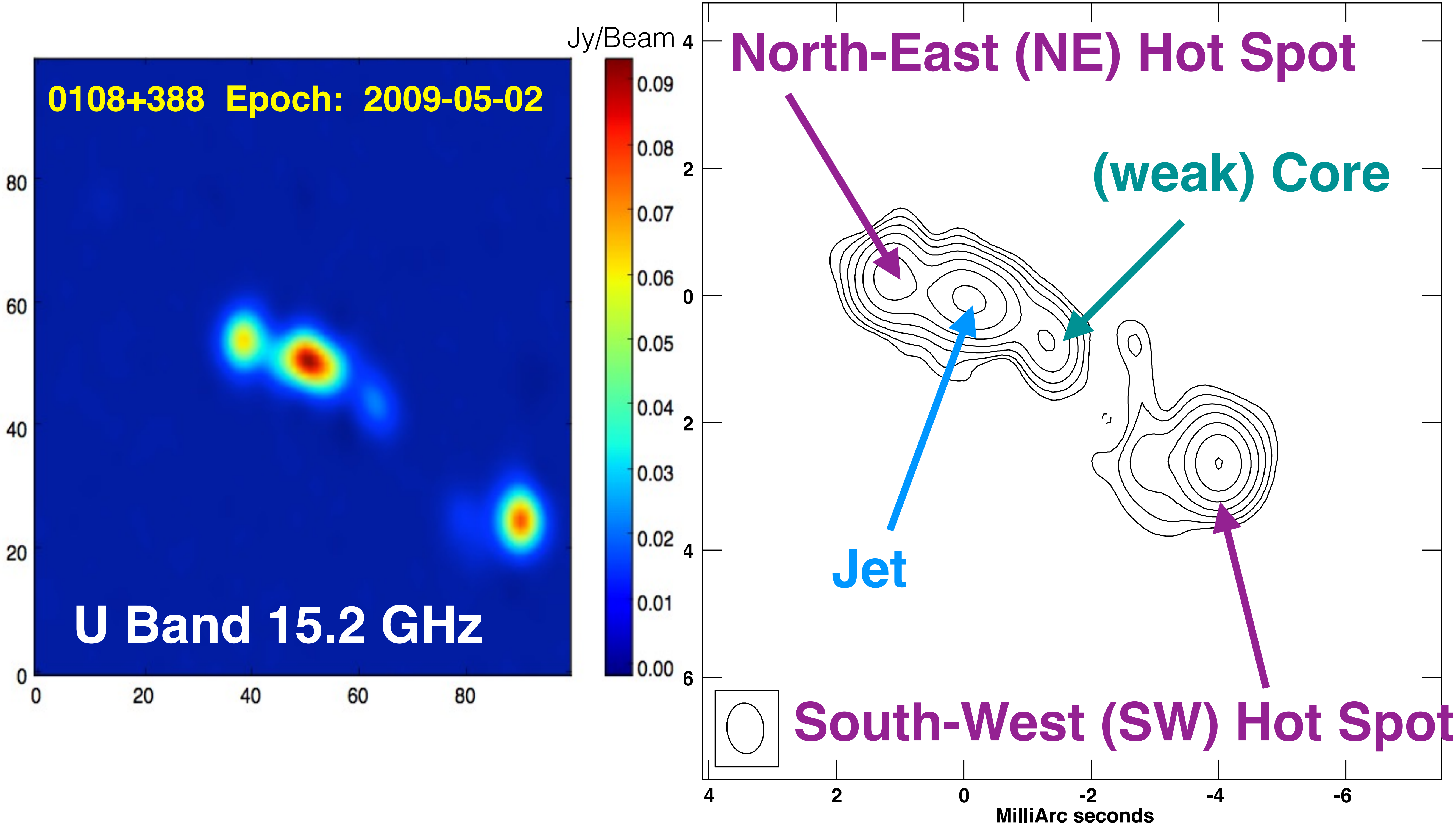
Fluxes Ratio:

$$\text{arm length ratio} = \frac{D_2}{D_1} \approx 2$$

0108+388


L Band
1.4 GHz
C Band
4.8 GHz
X Band
8.4 GHz
MilliArc seconds
MilliArc seconds

0108+388



This research has made use of data from the MOJAVE database that is maintained by the MOJAVE team (Lister et al., 2009, AJ, 137, 3718).

0108+388

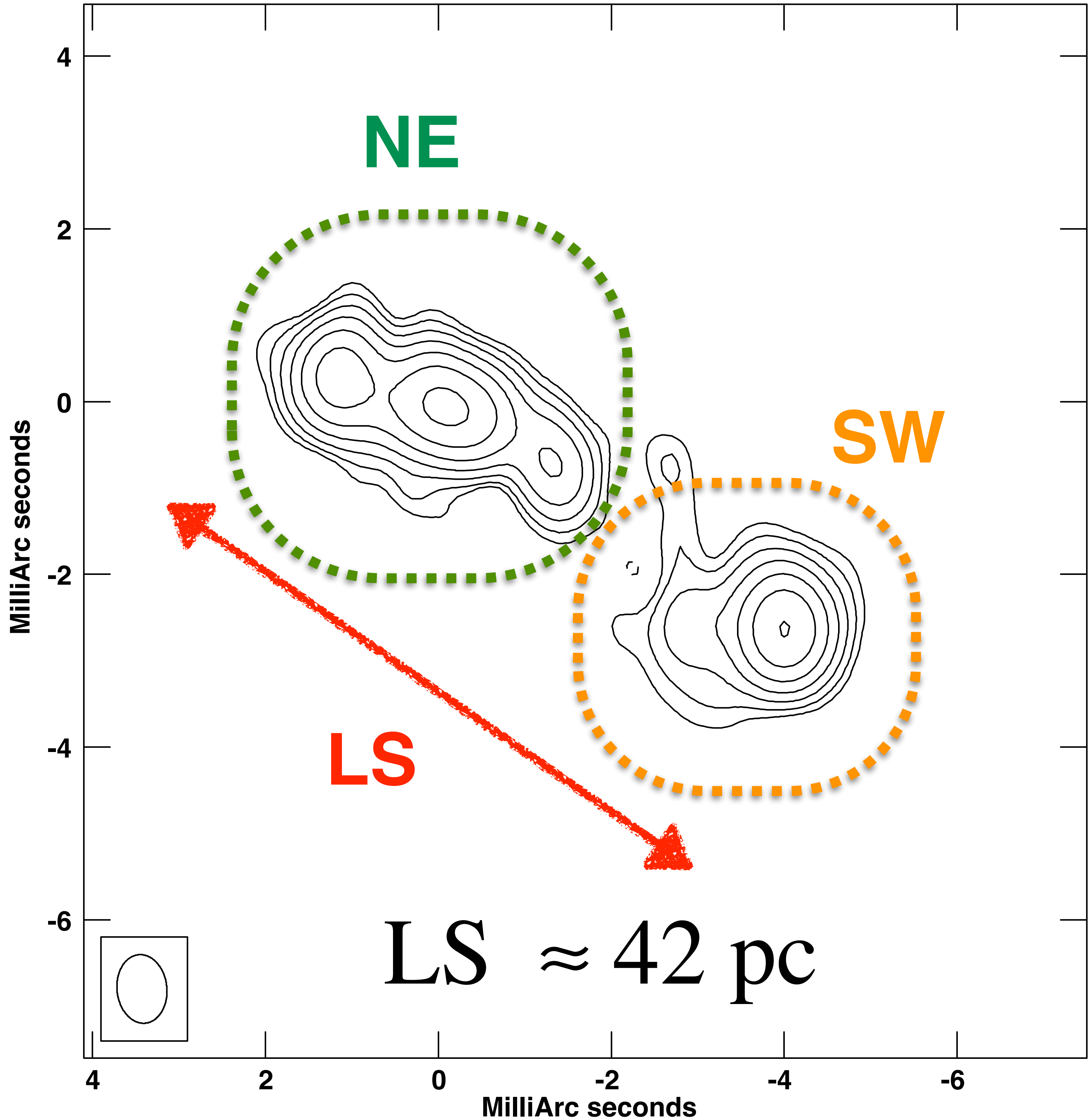
Fluxes Ratio:

L ⟶ $\frac{F_{NE}}{F_{SW}} \approx 1$

C ⟶ $\frac{F_{NE}}{F_{SW}} = 1.5$

X ⟶ $\frac{F_{NE}}{F_{SW}} \approx 2$

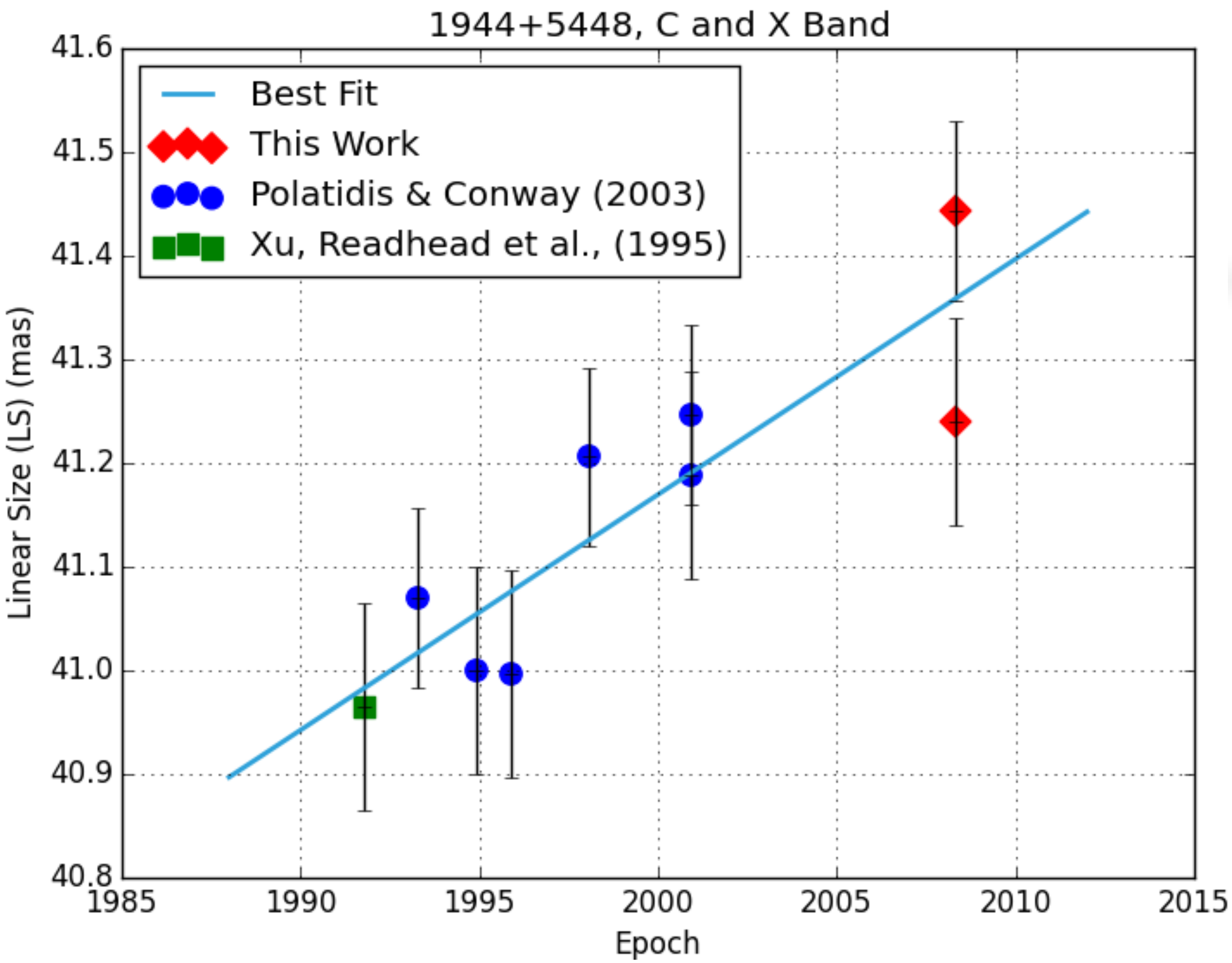
U ⟶ $\frac{F_{NE}}{F_{SW}} \geq 2$



Physical parameters:

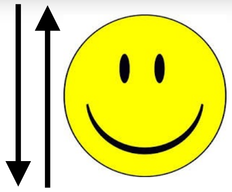
1944+543	Volume pc^3	$L_{(5GHz)}$ erg/s	$H_{(Equipartition)}$ mG	$P_{(Equipartition)}$ dyne/cm^2
East lobe	$2\ 10^4$	$2.6\ 10^{42}$	2.7	$1.6\ 10^{-6}$
East HS	94.7	$1.7\ 10^{43}$	22.5	$1.7\ 10^{-4}$
West Lobe	$9\ 10^4$	$1.2\ 10^{43}$	2.6	$1.7\ 10^{-6}$
West HS	85.6	$3.6\ 10^{43}$	28.6	$1.1\ 10^{-4}$
Core	67.2	$1.1\ 10^{42}$	12.6	$3.3\ 10^{-5}$

1944+543



Hot Spots separation speed

$$v_{sep} = 0.24 \pm 0.06c$$



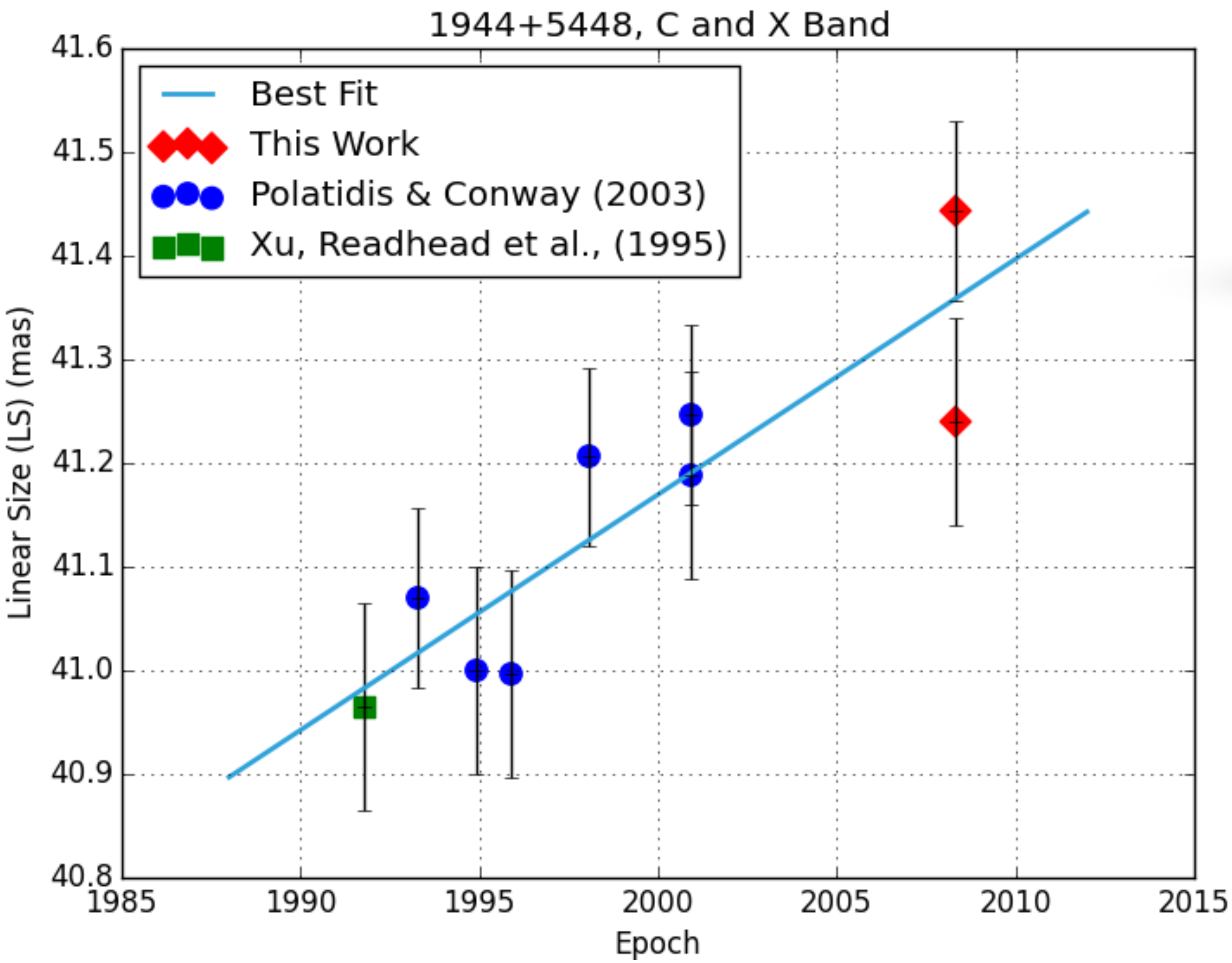
$$v_{sep} = 0.26 \pm 0.04c$$

(Polatidis & Conway 2003)

Kinematic Age

$$t_{kin} = 1800 \pm 400y$$

1944+543



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$$v_{sep} = 0.26 \pm 0.04c$$

(Polatidis & Conway 2003)

Kinematic Age

$$t_{kin} = 1800 \pm 400y$$

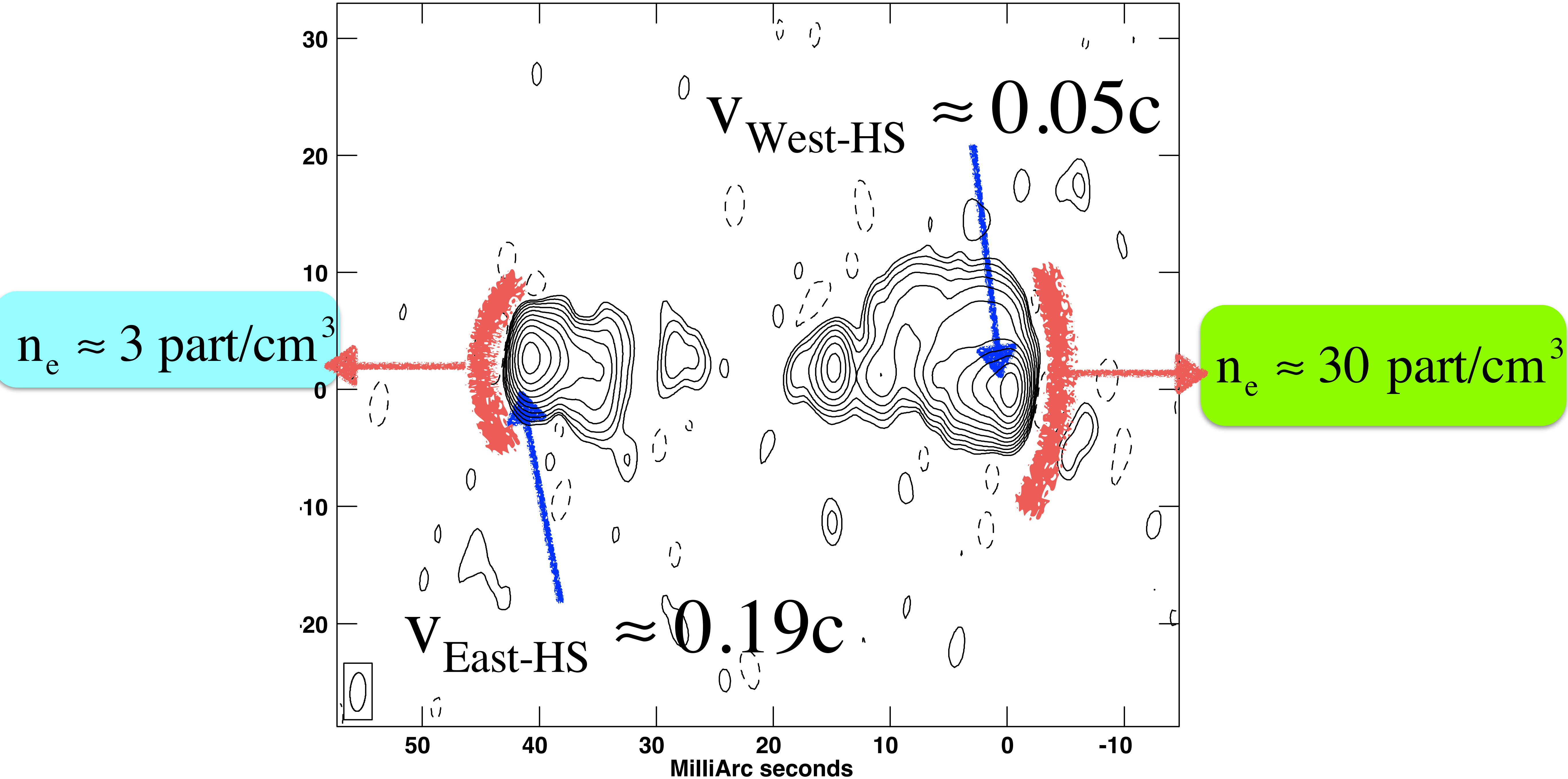
$$t_{rad} = 5.03 \times 10^4 \cdot H_{eq}^{-1.5} [(1+z)\, \nu_{break}]^{-0.5} \quad (yr)$$

Murgia (2003)

Radiative Age

$$t_{rad} = 1900 \pm 500y$$

J1944+5448



Equipartition Pressure ⟷ ***Ram Pressure***

0108+388

Hot Spots separation speed

$$v_{sep} = 0.07 \pm 0.02c$$

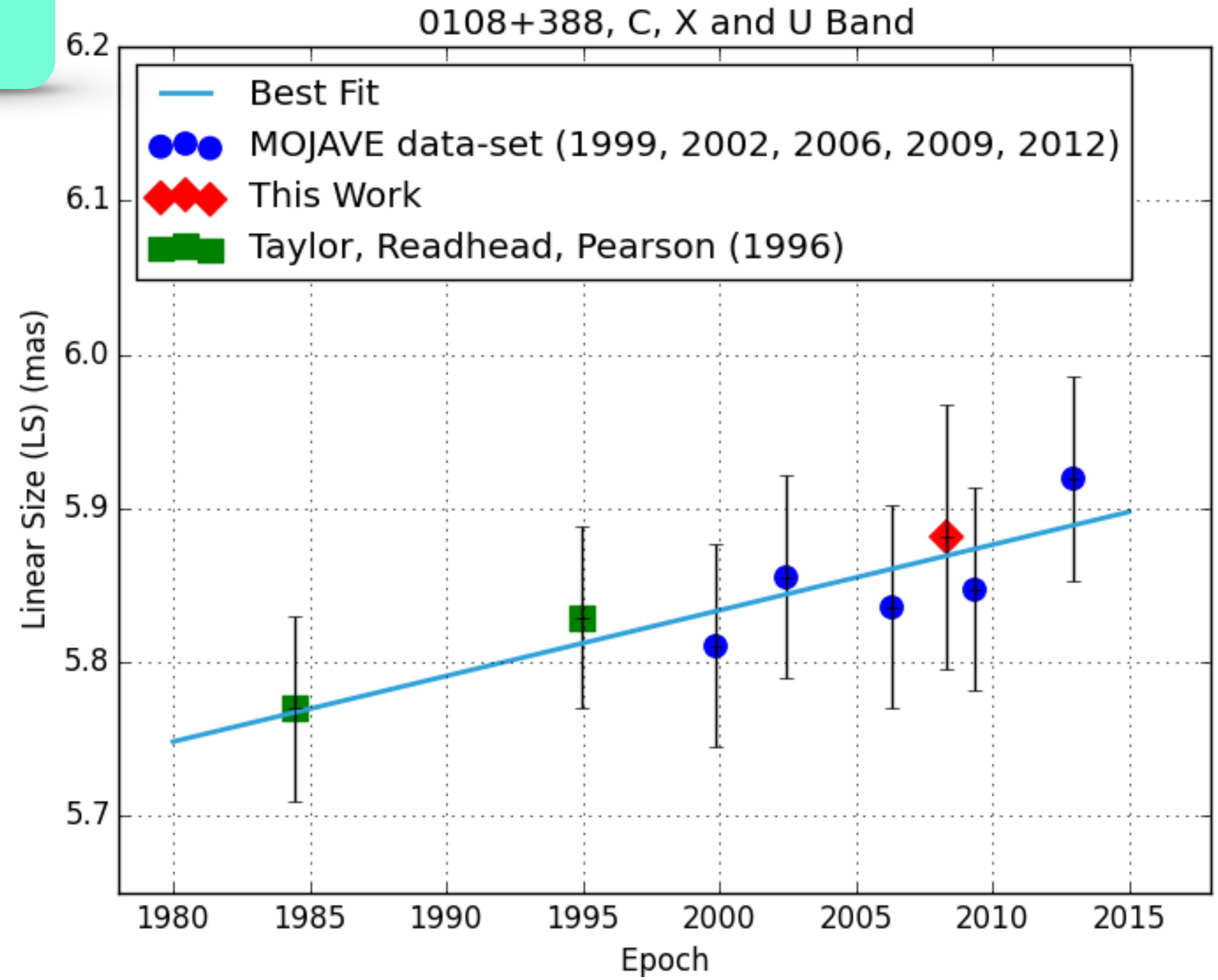
↓

$$v_{sep} = 0.02 \pm 0.01c$$

(Taylor, Marr et al., 2000)

Kinematic Age

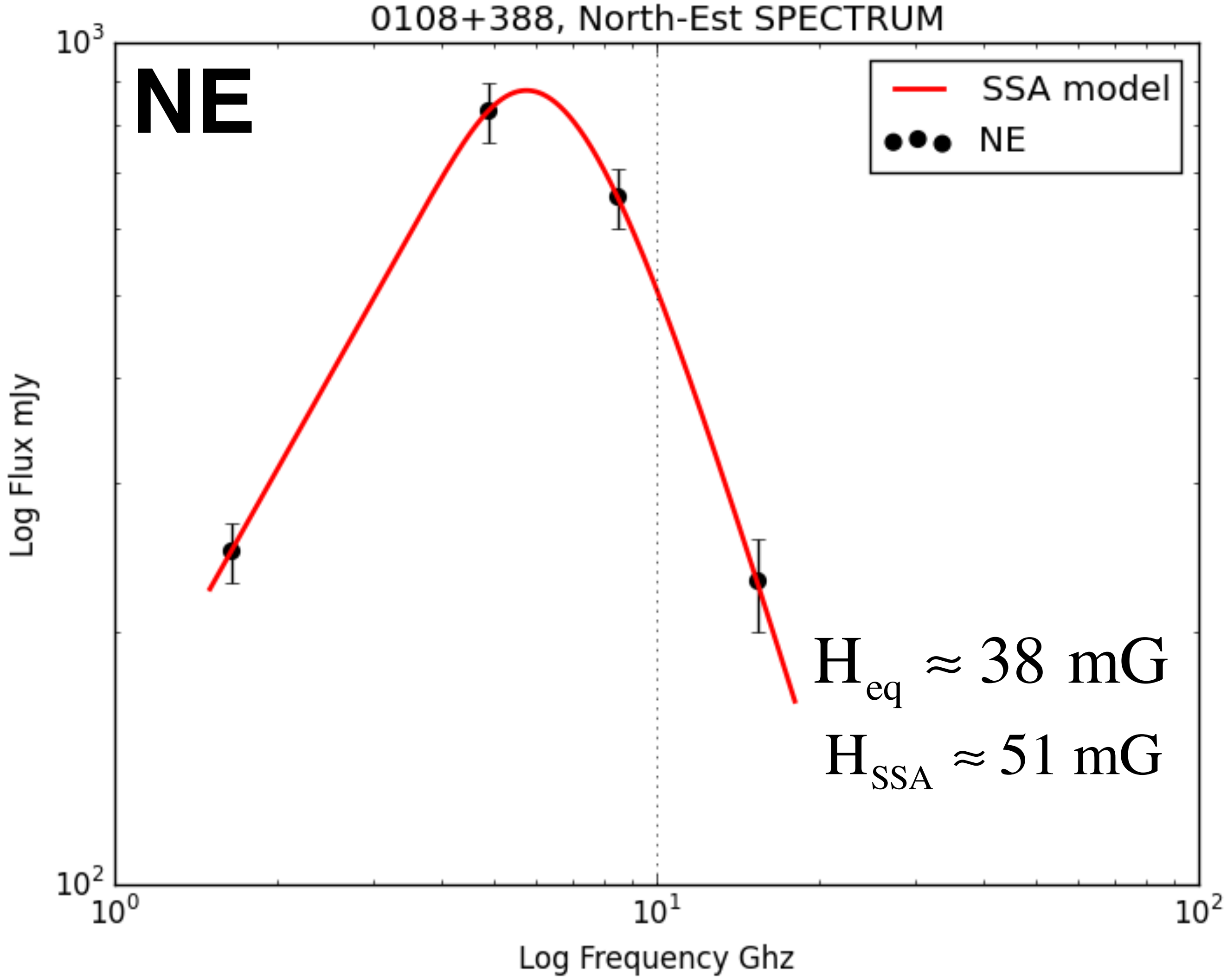
$$t_{kin} = 1100 \pm 500y$$

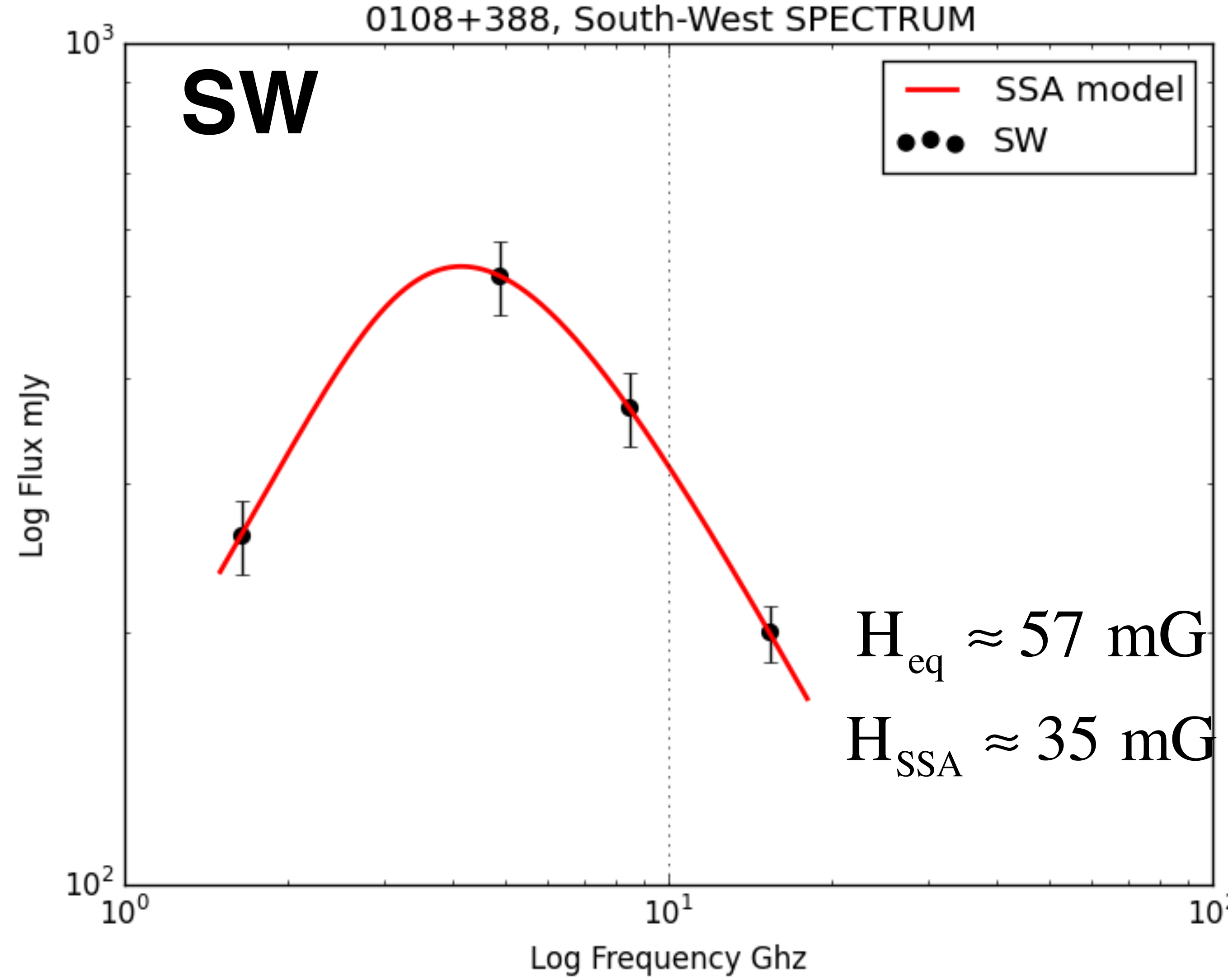


Physical parameters:

0108+388	Volume pc^3	$L_{(5GHz)}$ erg/s	$H_{(Equipartition)}$ mG	$P_{(Equipartition)}$ dyne/cm^2
North-East	402.9	$5.3\ 10^{44}$	38.1	$3.3\ 10^{-4}$
South-West	214.5	$3.4\ 10^{44}$	57.2	$7.2\ 10^{-4}$

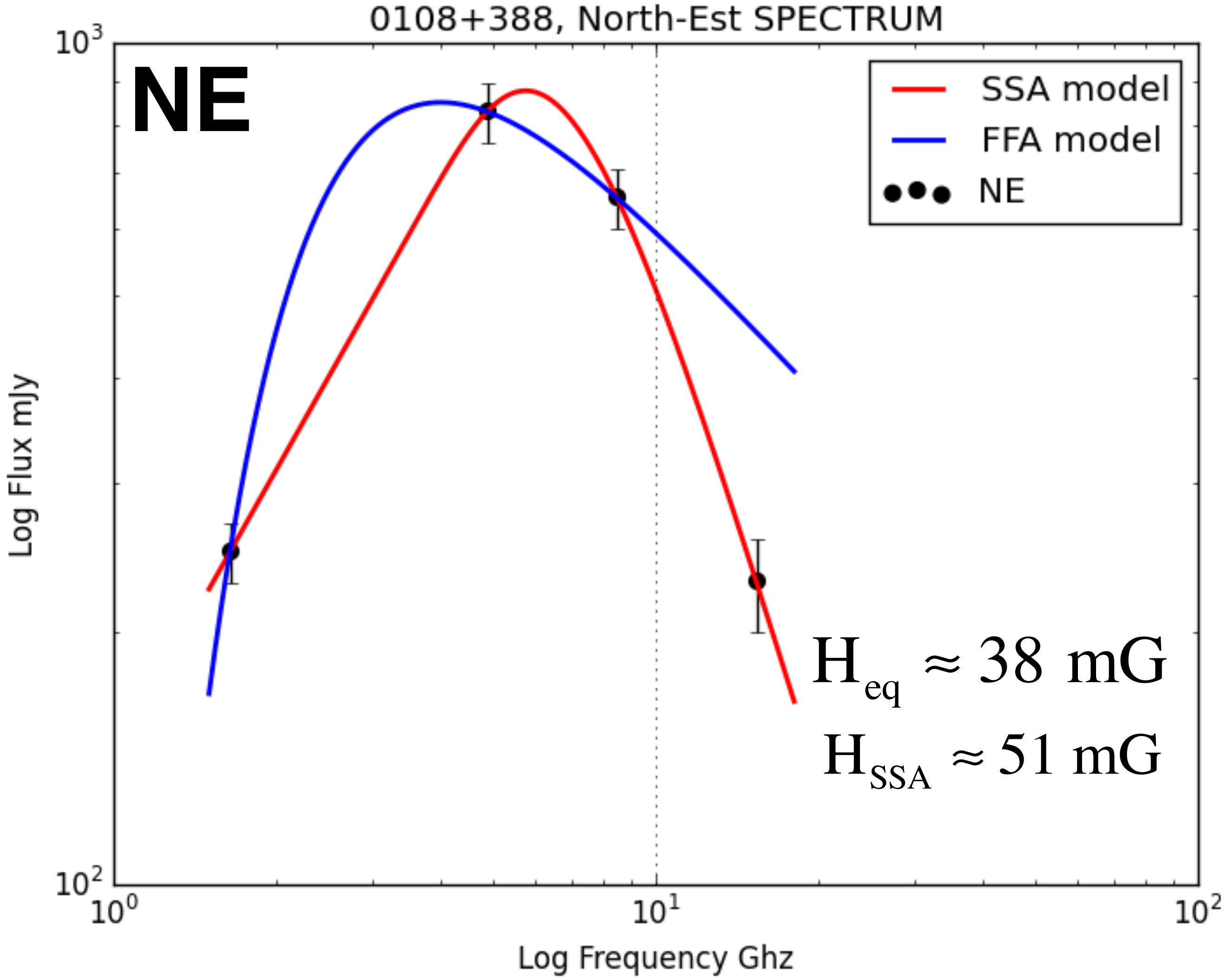
Spectral analysis 0108+388

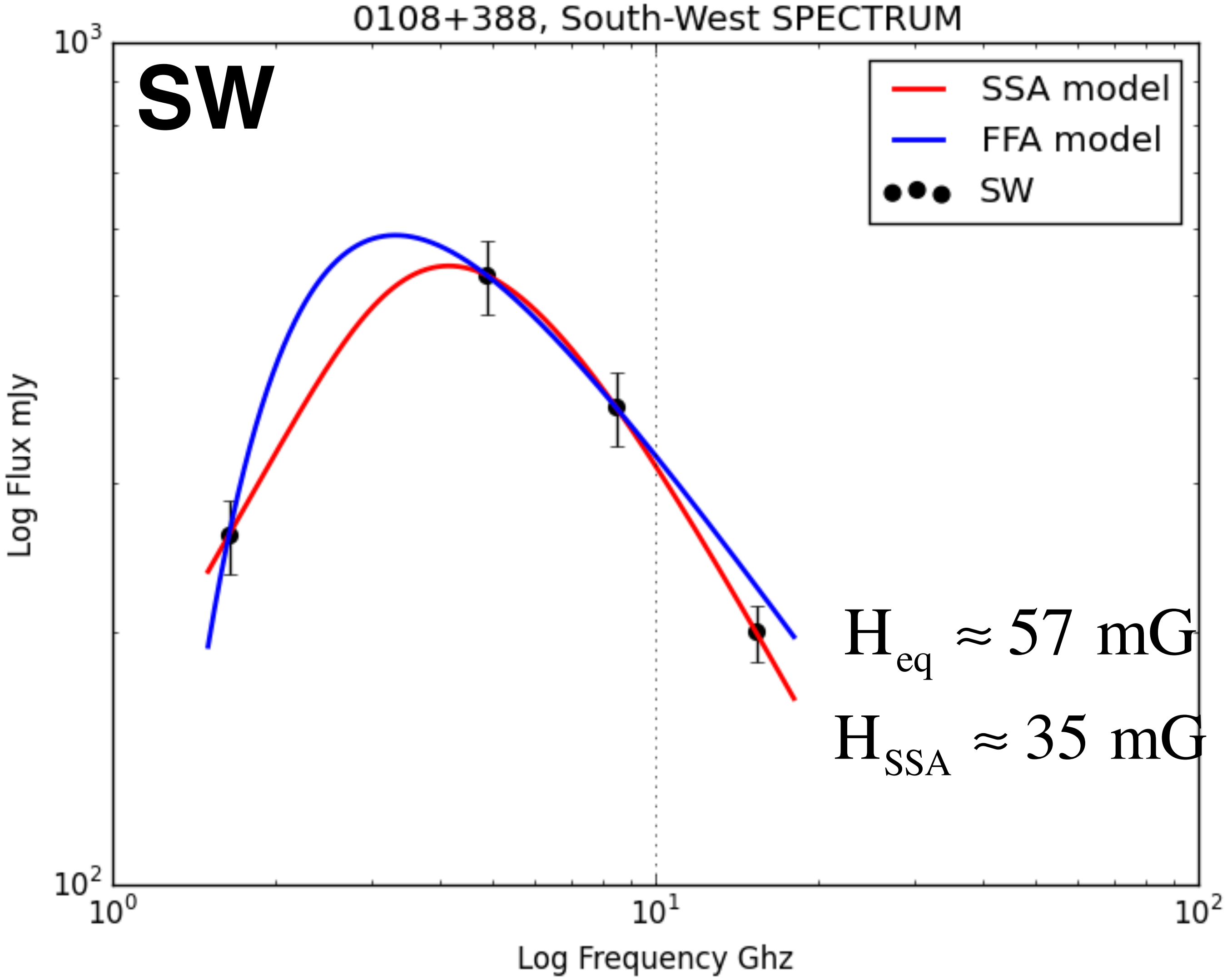




SSA $\nu_{peak} \approx 6.9$ GHz $S_{peak} \approx 816$ mJy $\nu_{peak} \approx 4.6$ GHz $S_{peak} \approx 530$ mJy

Spectral analysis 0108+388





	NE		SW	
SSA	$\nu_{peak} \approx 6.9$ GHz	$S_{peak} \approx 816$ mJy	$\nu_{peak} \approx 4.6$ GHz	$S_{peak} \approx 530$ mJy
FFA	$\nu_{peak} \approx 4$ GHz	$S_{peak} \approx 849$ mJy	$\nu_{peak} \approx 3.3$ GHz	$S_{peak} \approx 590$ mJy

Conclusions:

- **Young radio sources!** → $t \approx 2 \cdot 10^{3}$ years

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- **Different magnetic fields** **0108+388** → $H \approx 60mG$

  1944+543 → $H \approx 20mG$

Conclusions:

- **Young radio sources!** → $t \approx 2 \cdot 10^3$ years
- **1944+5448 inhomogeneous medium** → **Asymmetric source!**
- **Different magnetic fields** **0108+388** → $H \approx 60mG$
  1944+543 → $H \approx 20mG$
- **0108+388 SSA or FFA?** →

Thank for you attention!

SSA Model

In this case: $S(\nu) \propto \nu^{\alpha}$

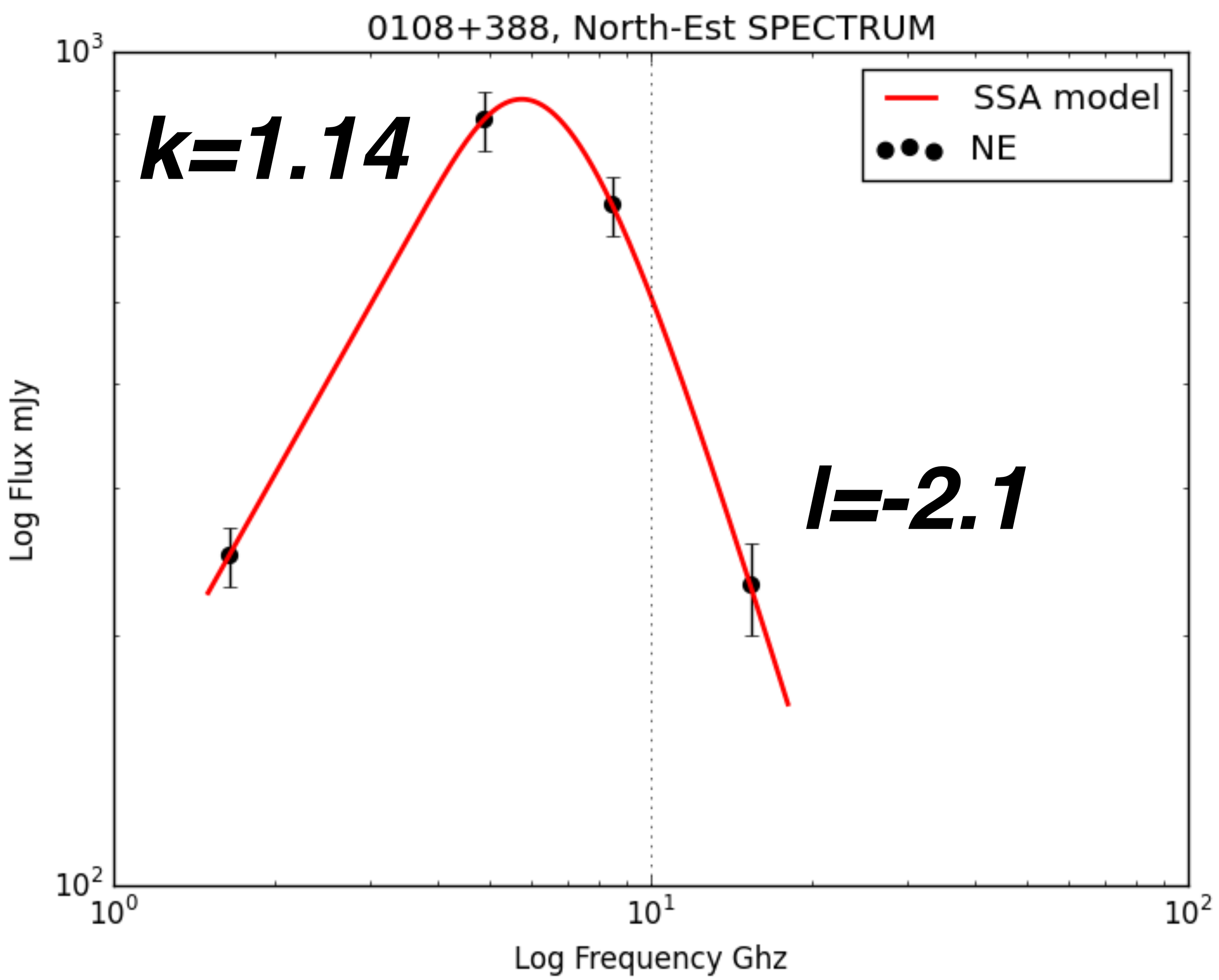
$$S(\nu) = \frac{S_{\max}}{(1-e^{-1})} \cdot \left(\frac{\nu}{\nu_{\max}}\right)^{k} \cdot \left(1 - e^{-\left(\frac{\nu}{\nu_{\max}}\right)^{(l-k)}}\right)$$

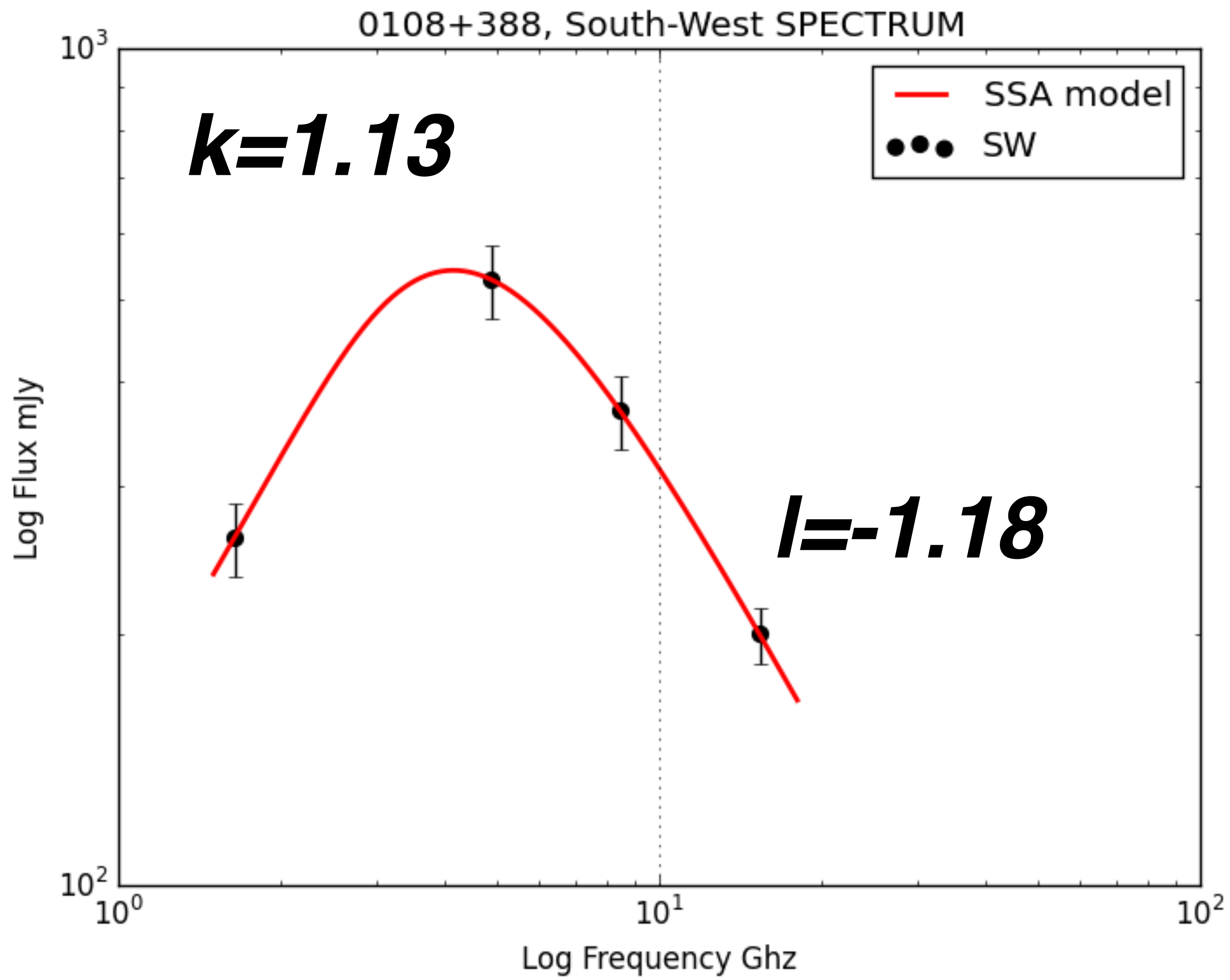
k → **optically thick**

l → **optically thin**

" A new sample of Faint GigaHertz Peaked Spectrum Radio Sources" *Snellen, Schilizzi, de Bruyn, Miley, Rengelink, Rottgering, Bremer 2008*

SSA Model


0108+388, North-Est SPECTRUM
SSA model
NE
k=1.14
l=-2.1
Log Flux mJy
Log Frequency Ghz
10^3
10^2
10^0
10^1
10^2

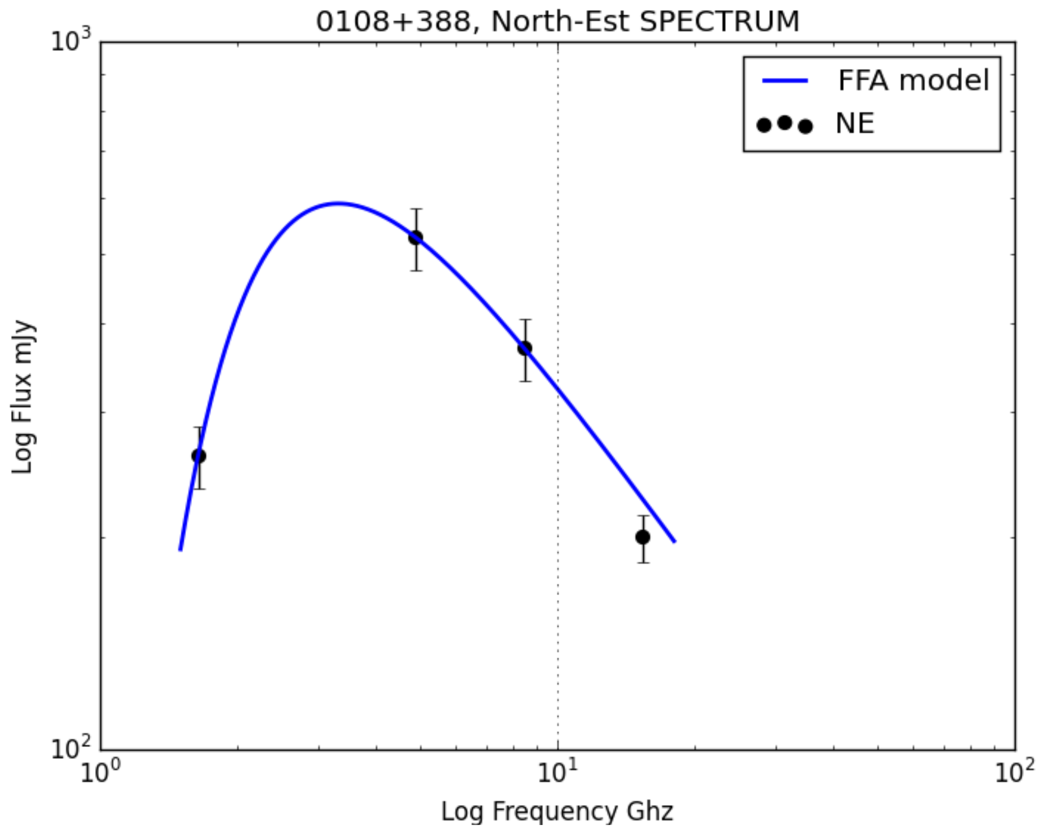

0108+388, South-West SPECTRUM
SSA model
SW
k=1.13
l=-1.18
Log Flux mJy
Log Frequency Ghz
10^3
10^2
10^0
10^1
10^2

FFA Model

Optical depth $$\tau_\nu = 0.08235\ \nu^{-2.1} \int T_e^{-1.35} N_e^2\ dl$$

Emission measure $$\int N_e^2\ dl$$

$$F_\nu = F_0 \left[\frac{\nu}{(1.5359\ \mathrm{GHz})} \right]^\alpha e^{-\left(\frac{EMT^{-1.35}}{\nu^{2.1}} \right)}$$



"Nonuniform Fre Free absorption in the GPS 0108+388"

Marr, Taylor, Crawford 2001, ApJ 550:160-171

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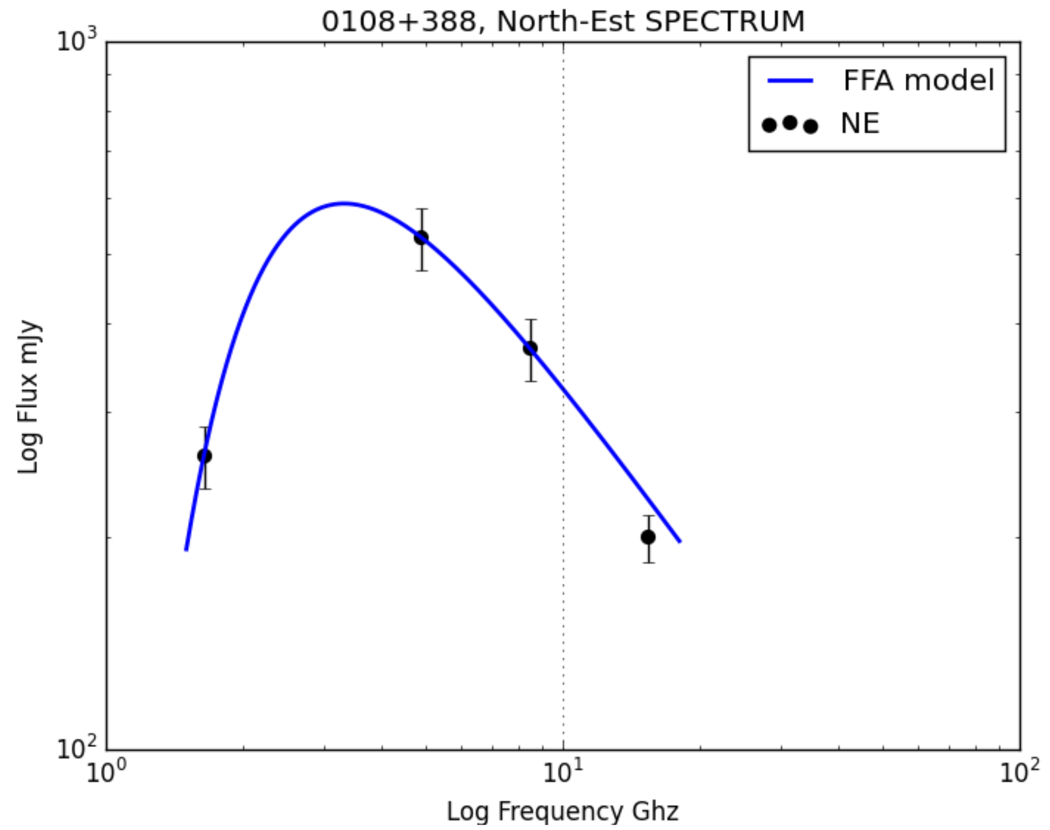

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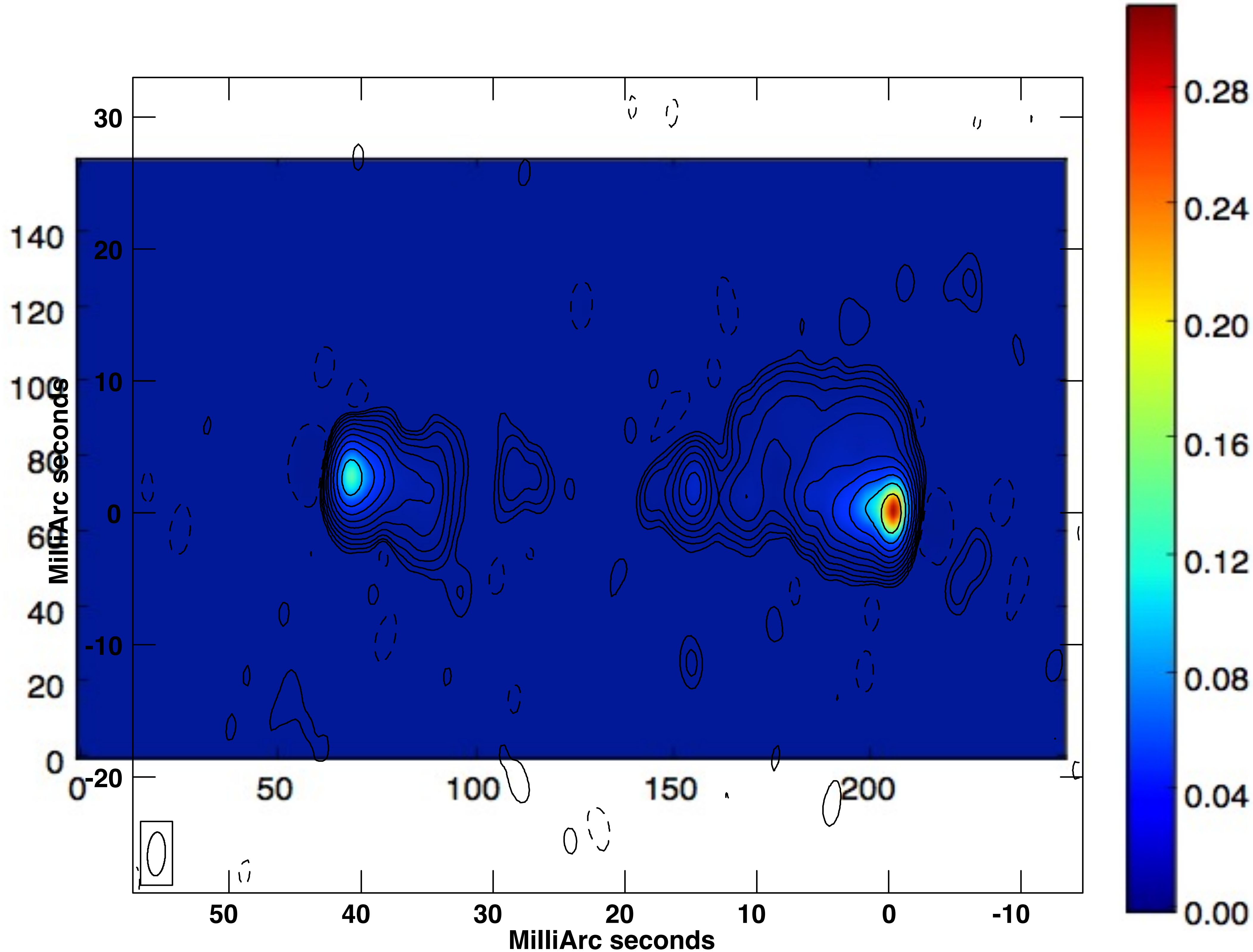
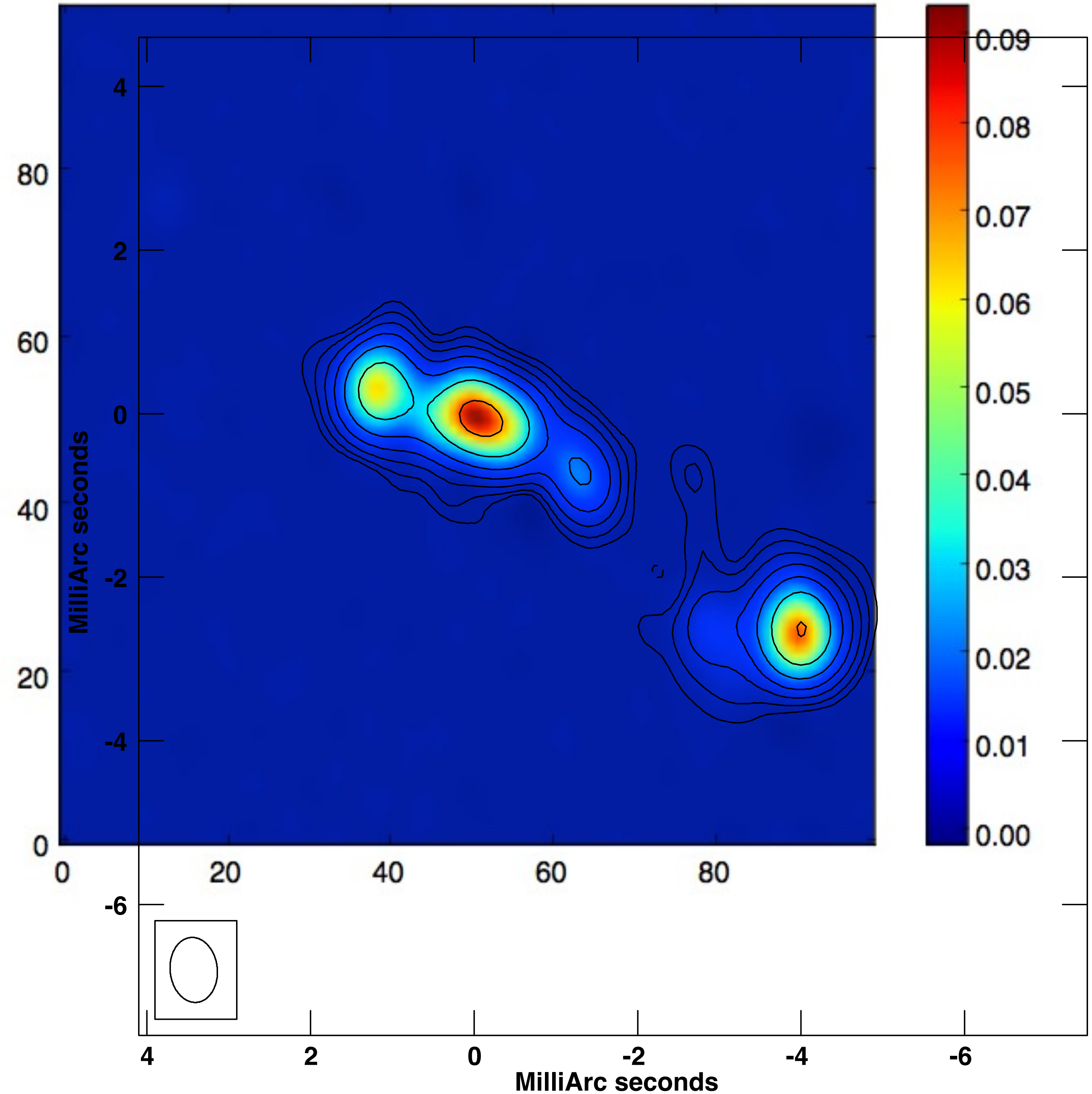
Magnetic Field

$$H_{eq} = 4.5^{2/7} \, (1+k)^{2/7} \, c_{el}^{2/7} L^{2/7} \, V^{-2/7}$$ mG

$$H_{SSA} = f^{-5} \, \theta_{max}^{2} \, \theta_{min}^{2} \, \nu^{5} \, S^{-2}$$ mG



MilliArc seconds
MilliArc seconds
0.28
0.24
0.20
0.16
0.12
0.08
0.04
0.00



MilliArc seconds
MilliArc seconds
4
2
0
-2
-4
-6
0
20
40
60
80
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09