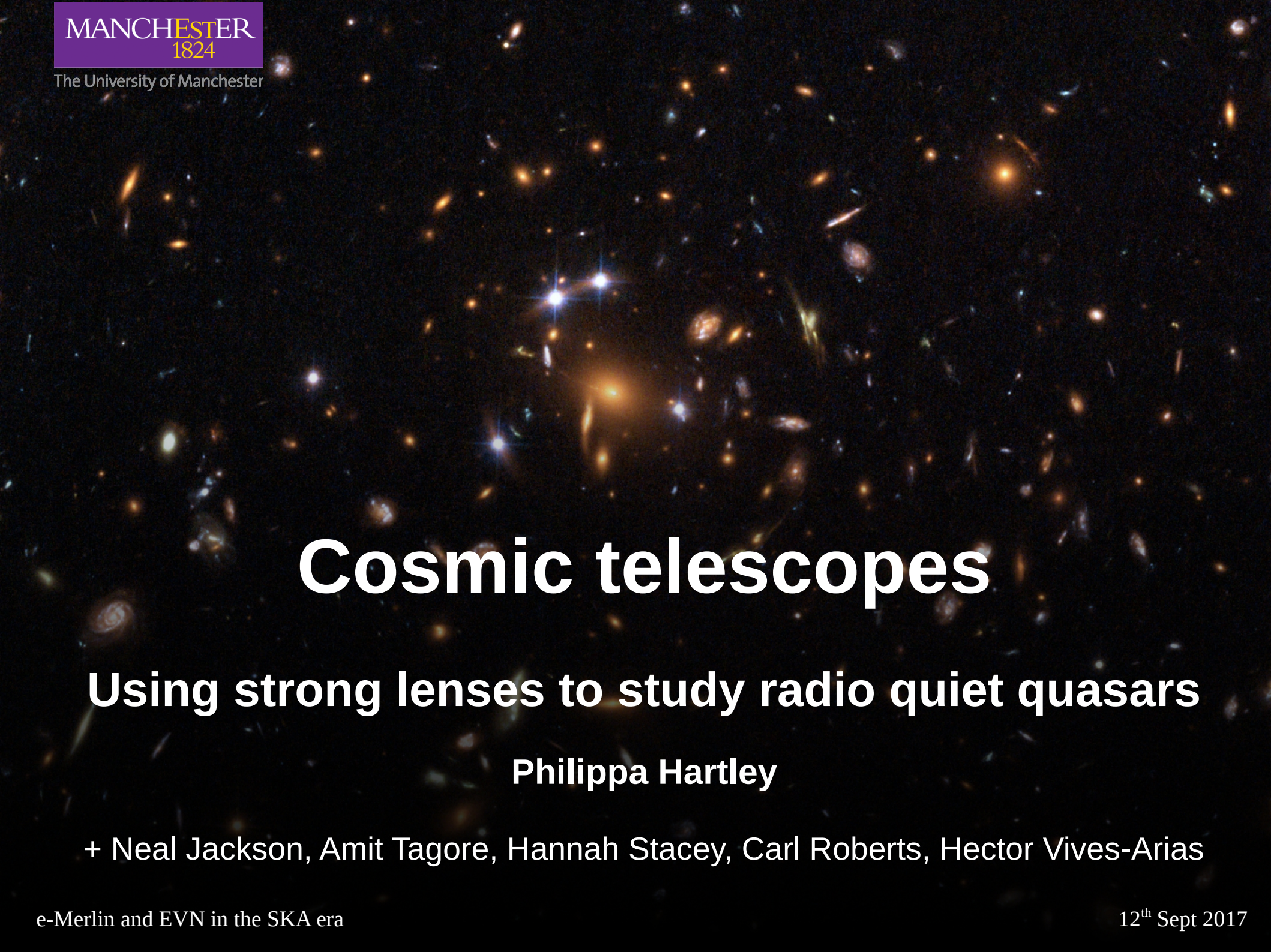

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Cosmic telescopes

Using strong lenses to study radio quiet quasars

Philippa Hartley

+ Neal Jackson, Amit Tagore, Hannah Stacey, Carl Roberts, Hector Vives-Arias

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Where are all the quasars?

3C175 VLA 6cm
NRAO 1996

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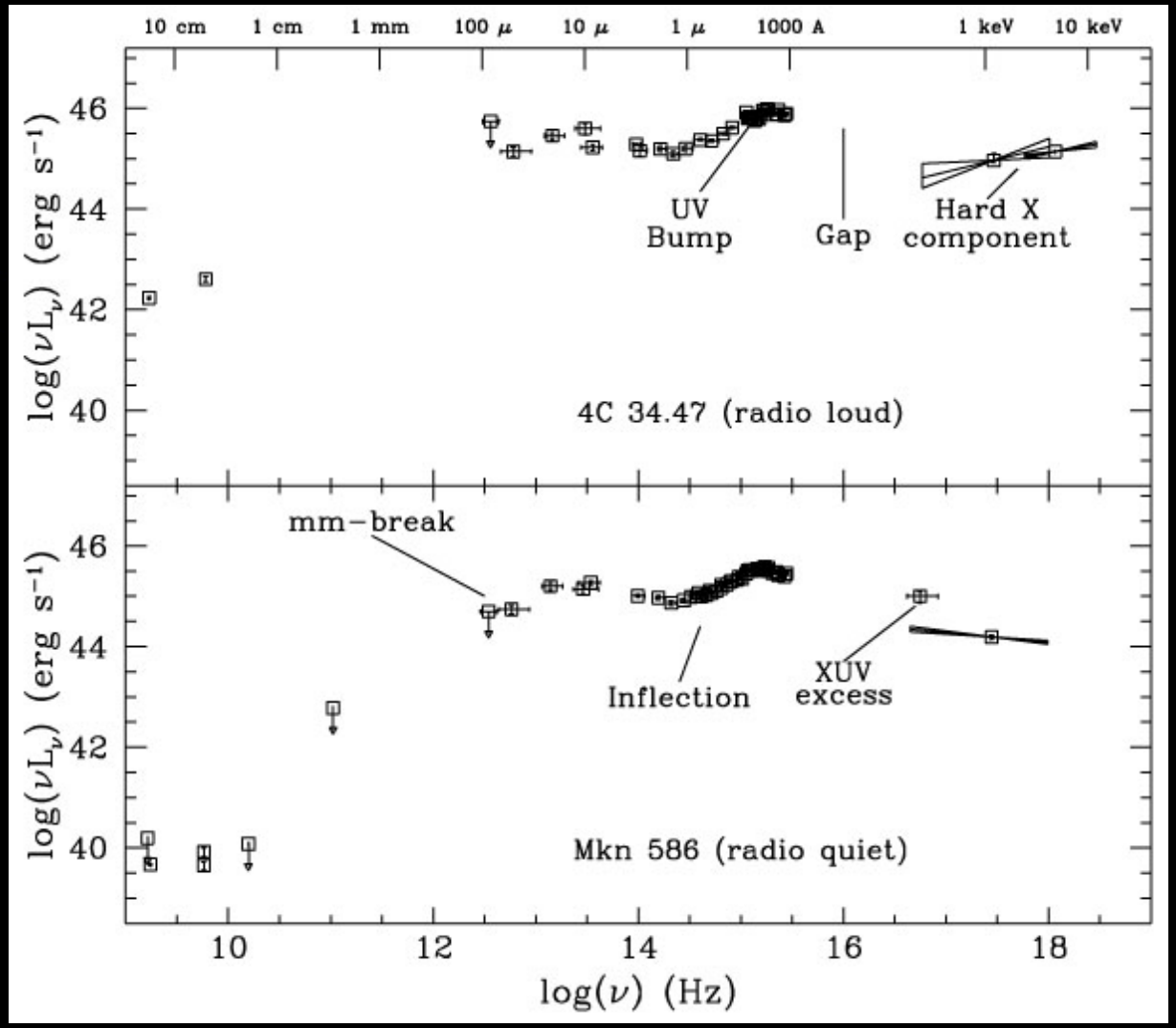
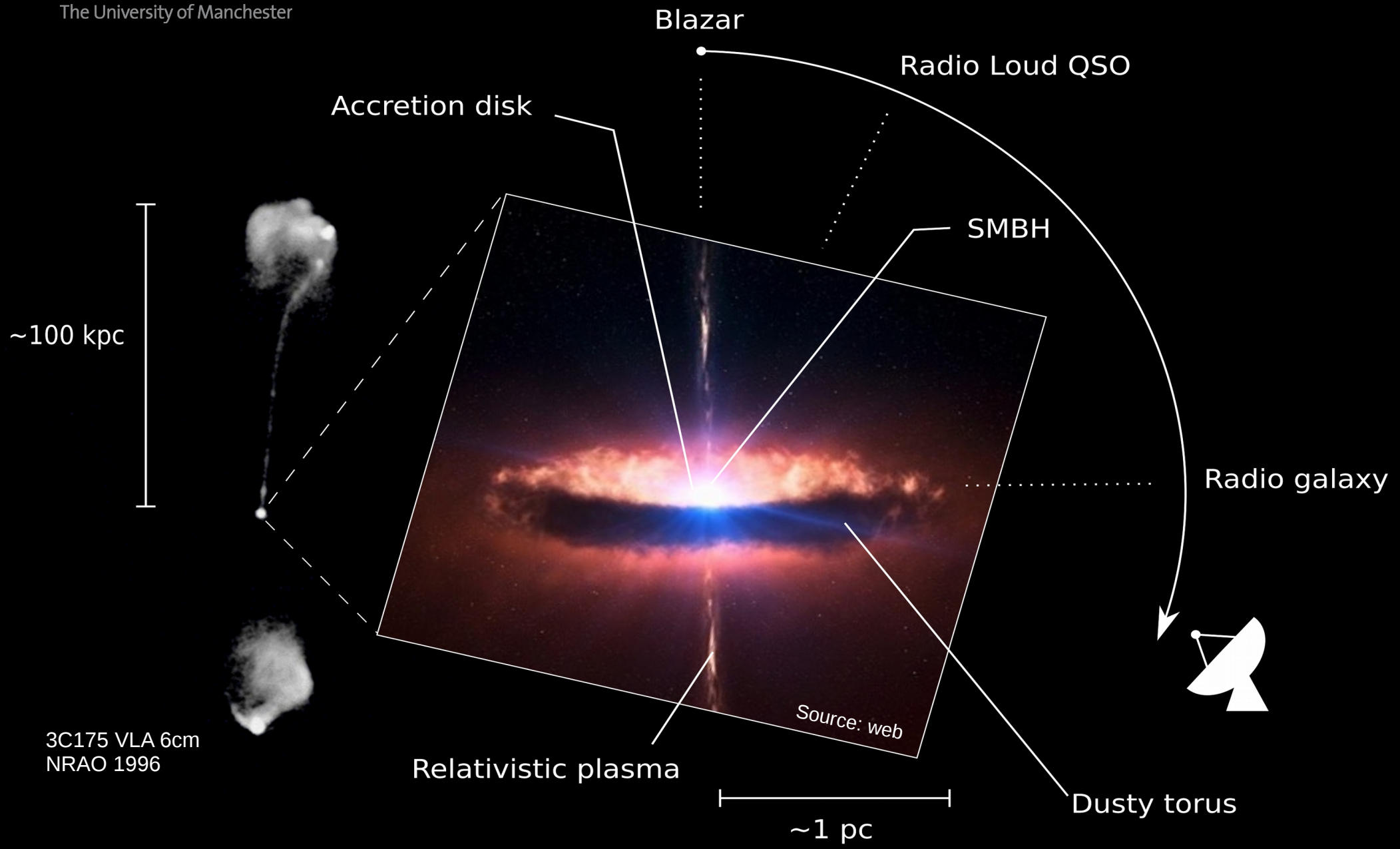


Elvis et al. 1994


Blazar
Radio Loud QSO
Accretion disk
SMBH
~100 kpc
Radio galaxy
Source: web
3C175 VLA 6cm
NRAO 1996
Relativistic plasma
Dusty torus
~1 pc

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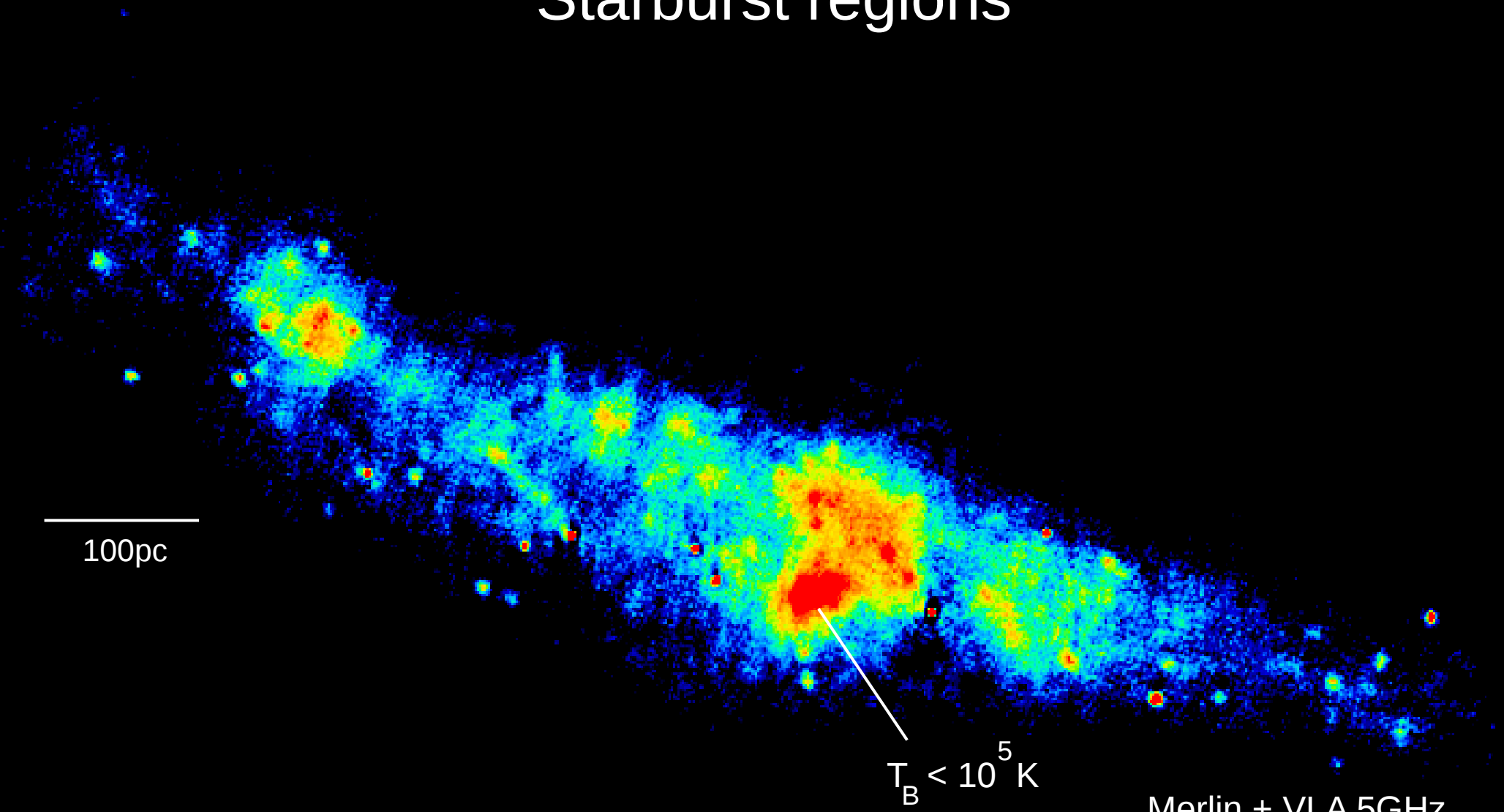
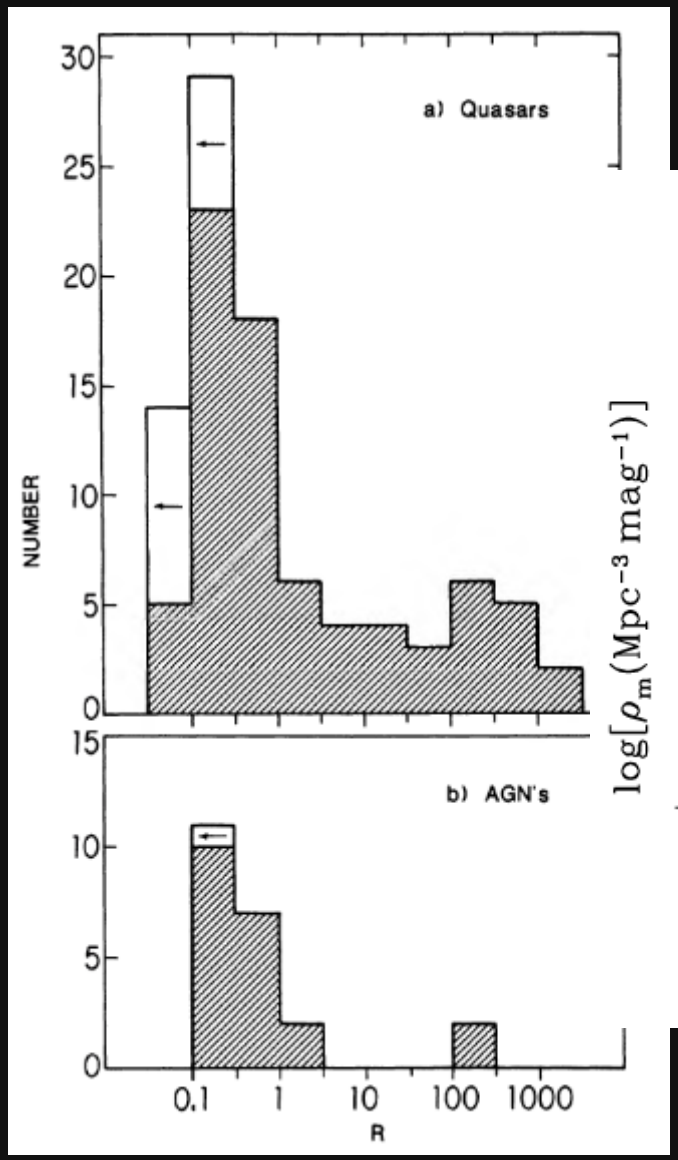
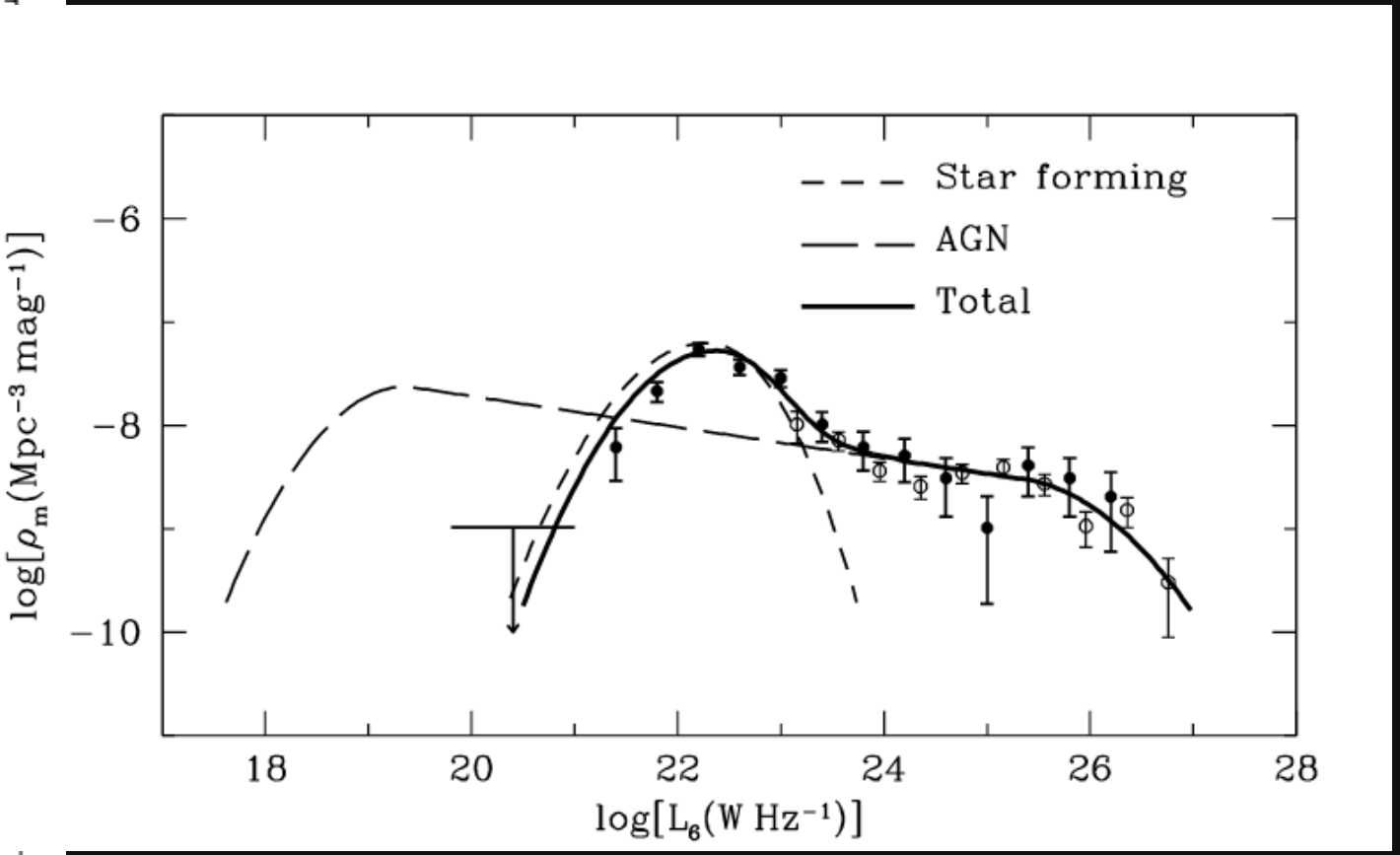
Starburst regions



Evidence so far: indirect



Kellerman et al, 1990



Kellerman et al., 2016

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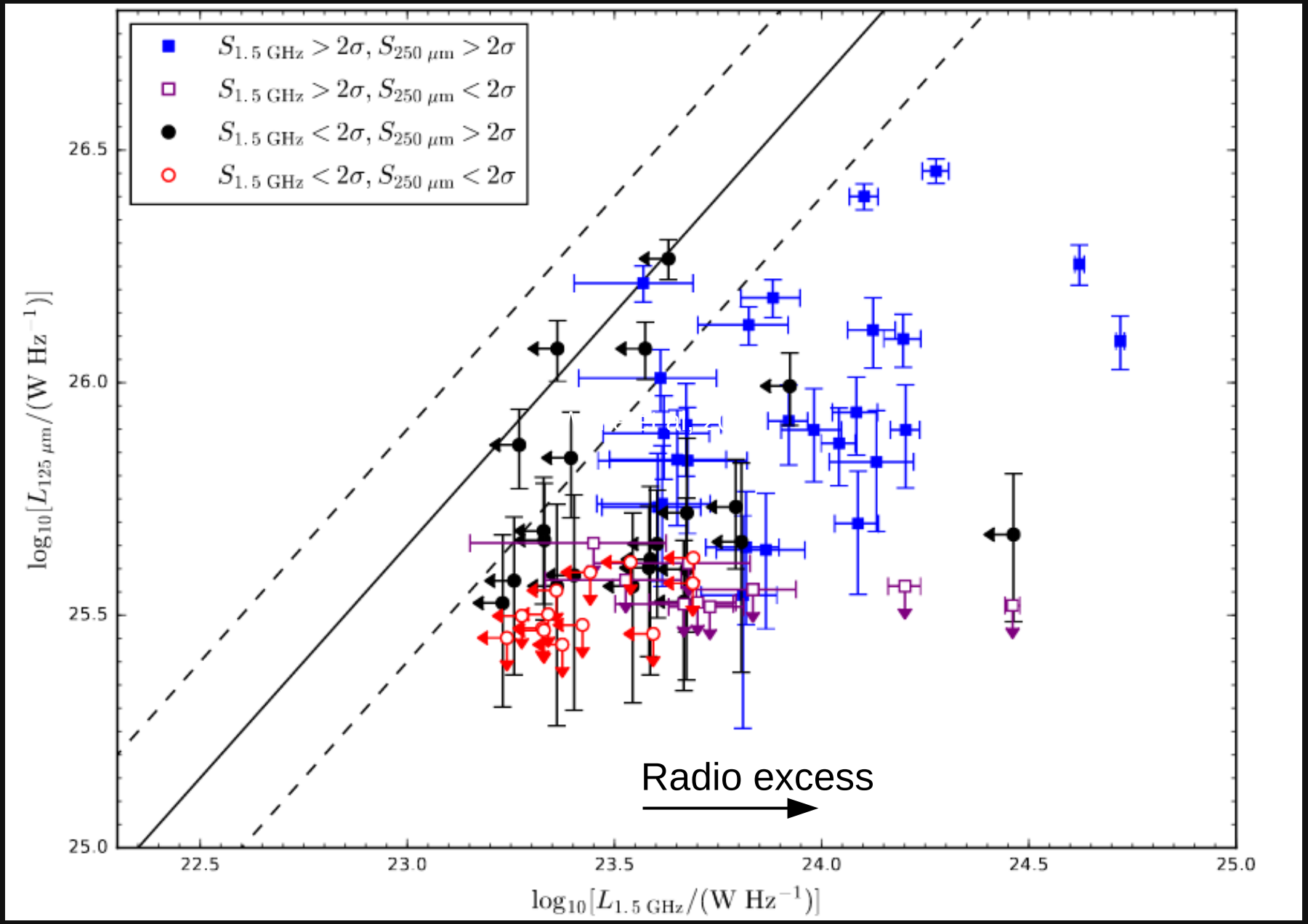
Evidence so far: indirect



White et al, 2017

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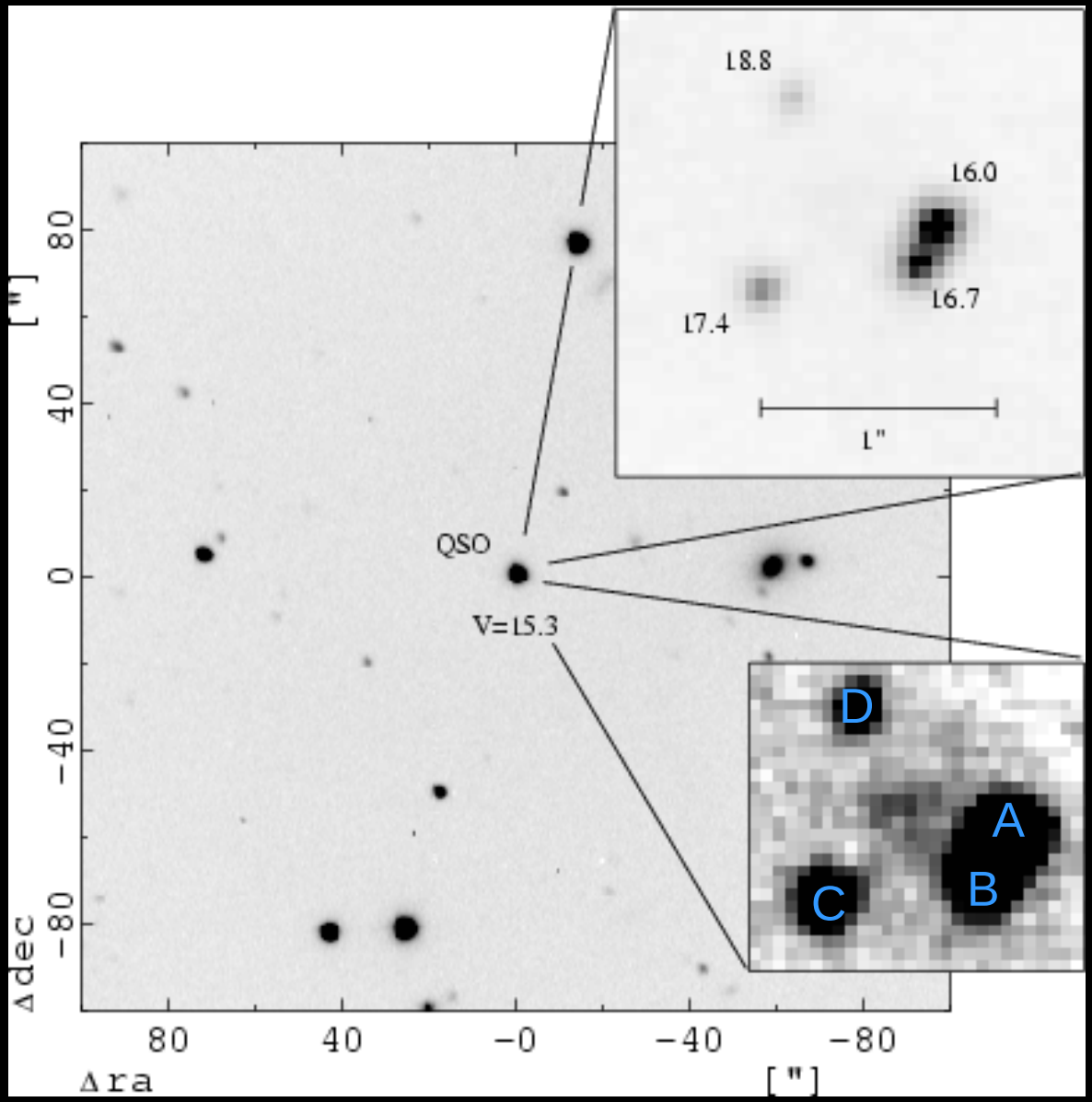
QSO 0810+2554

Hubble V band



mag = 16.0 max

Reimers et al., 2002

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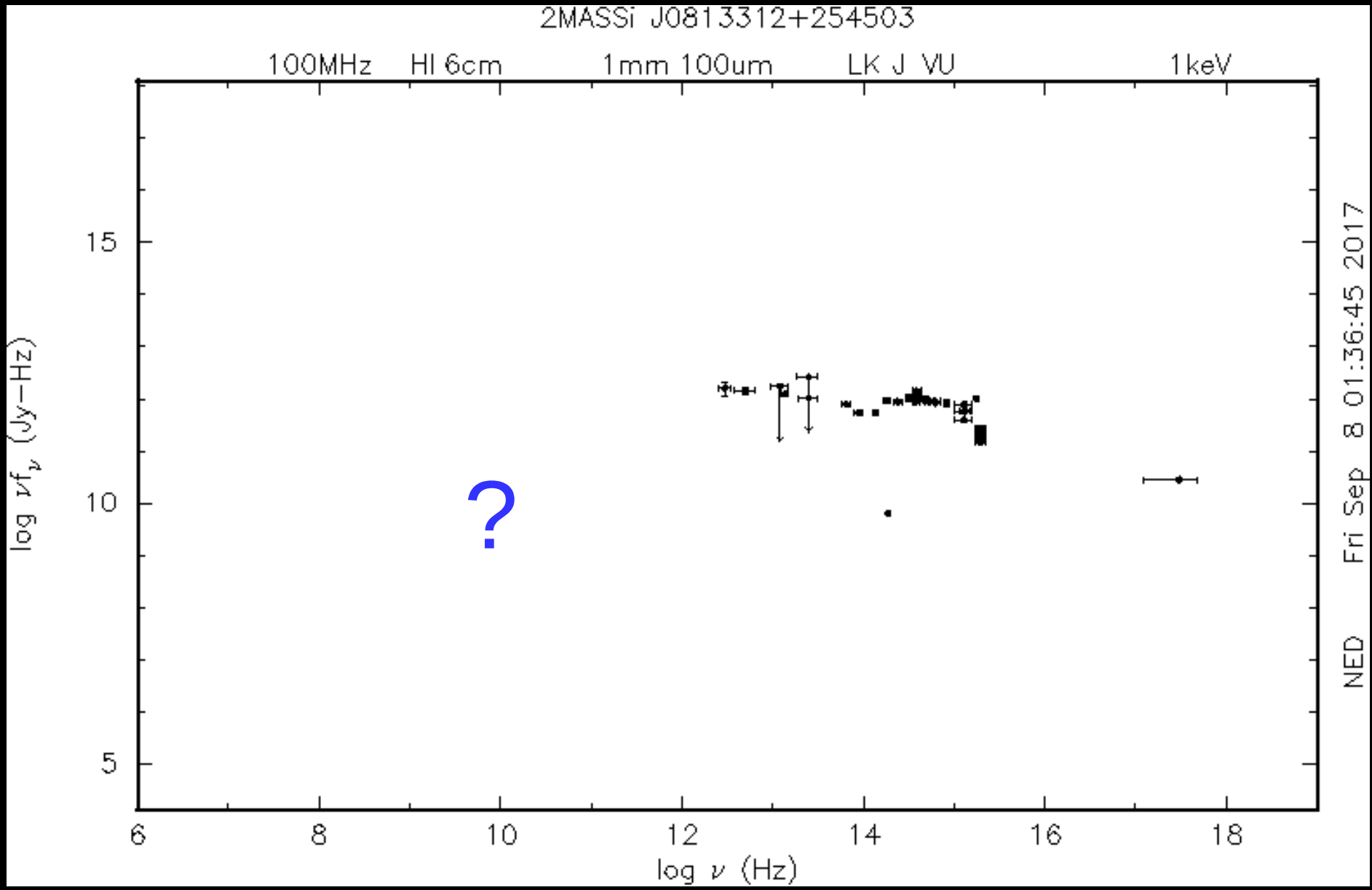
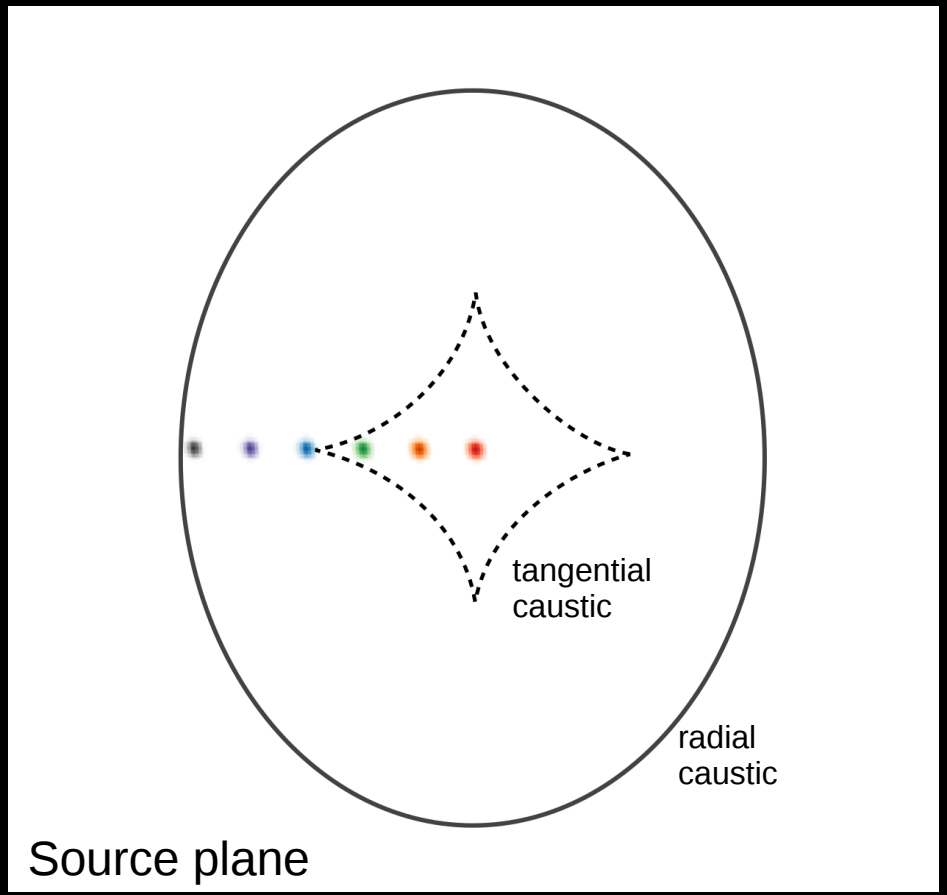
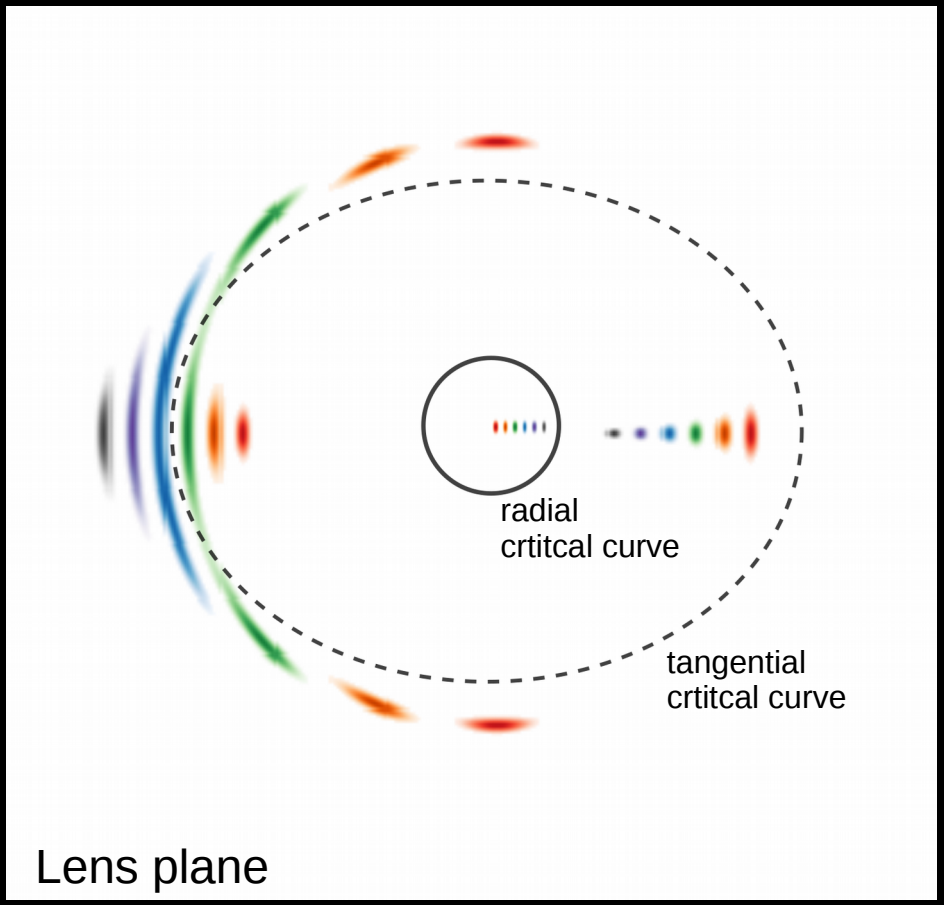
QSO 0810+2554



Lensing geometry

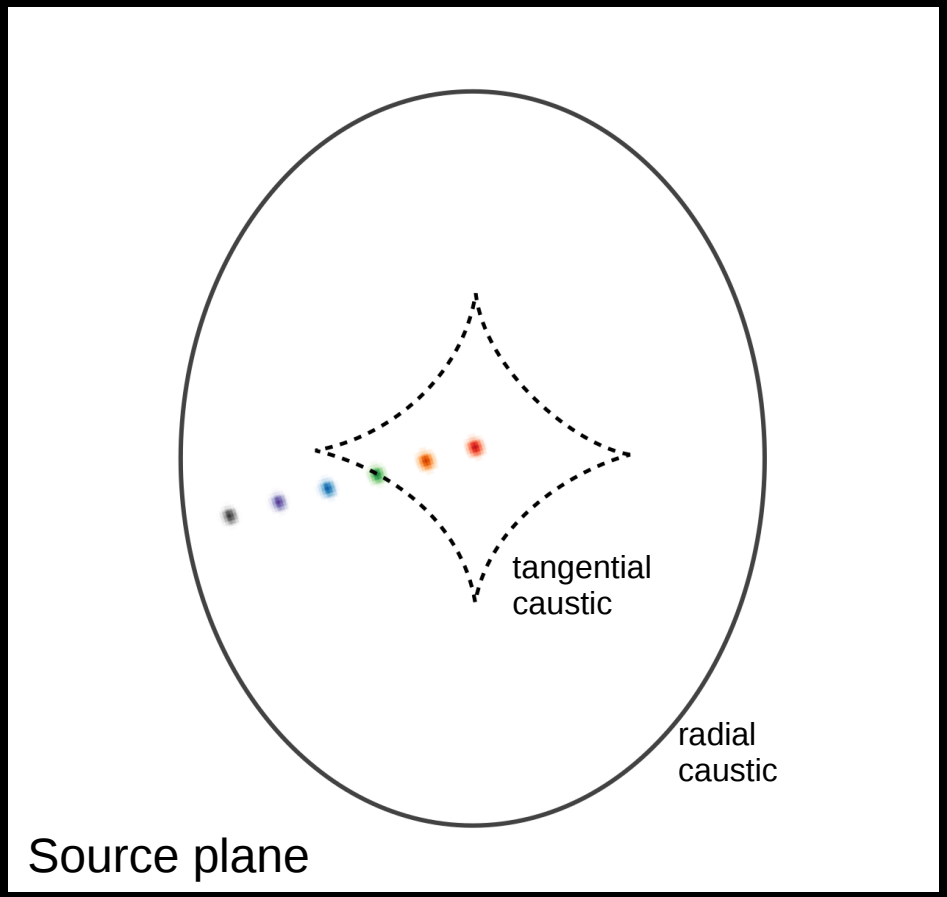
Cusp configuration

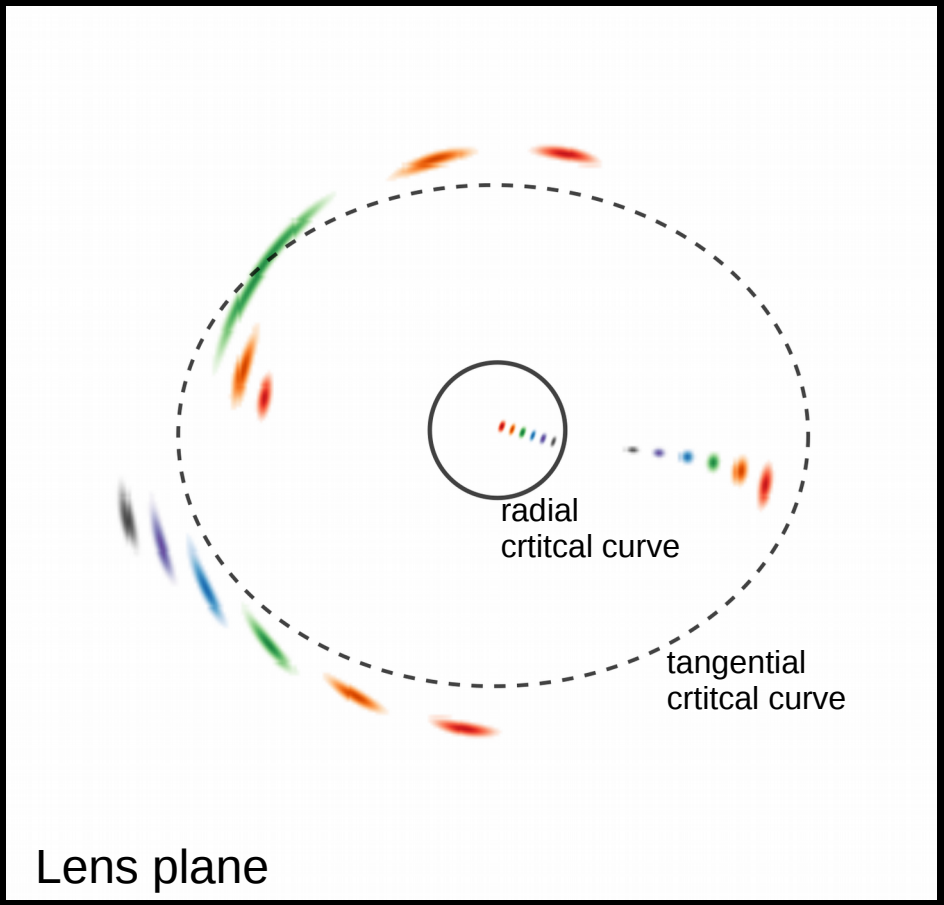




Lensing geometry

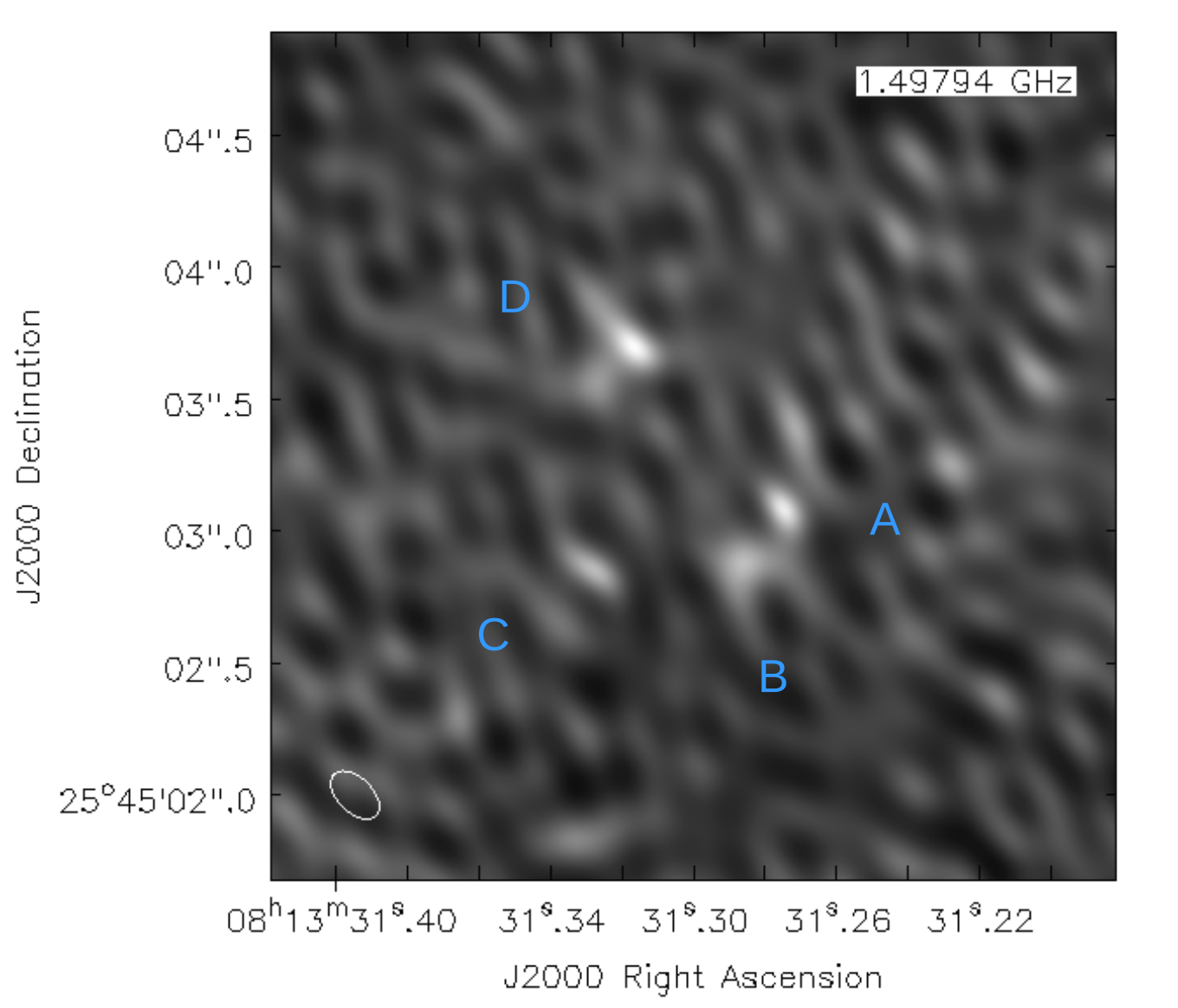
Fold configuration





QSO 0810+2554

e-Merlin 1.4GHz



A = 161 uJy
α = -0.55

Jackson et al., 2015

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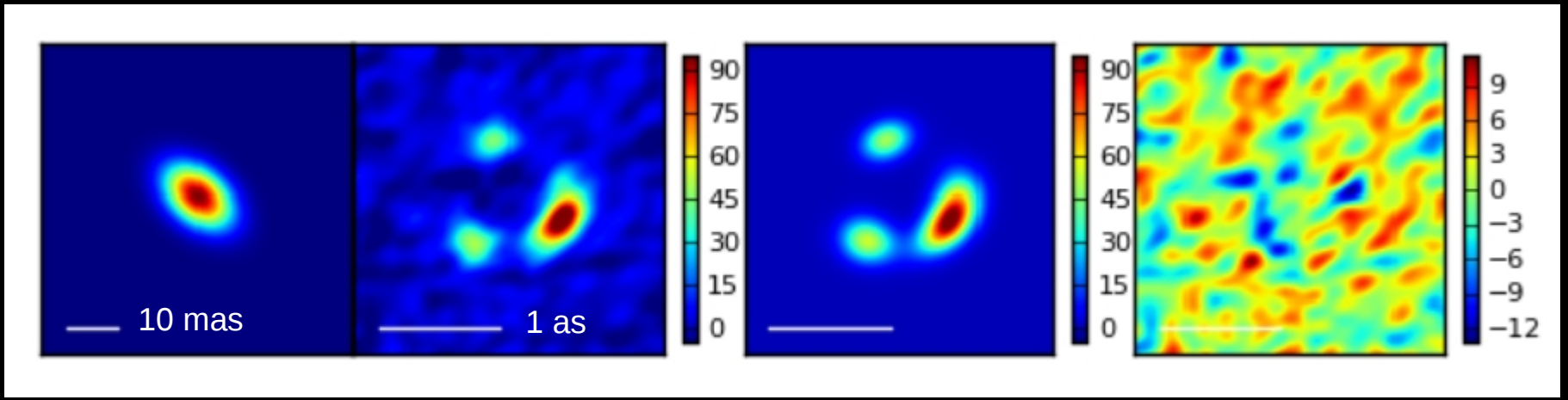
QSO 0810+2554

e-Merlin 1.4GHz



Jackson et al., 2015

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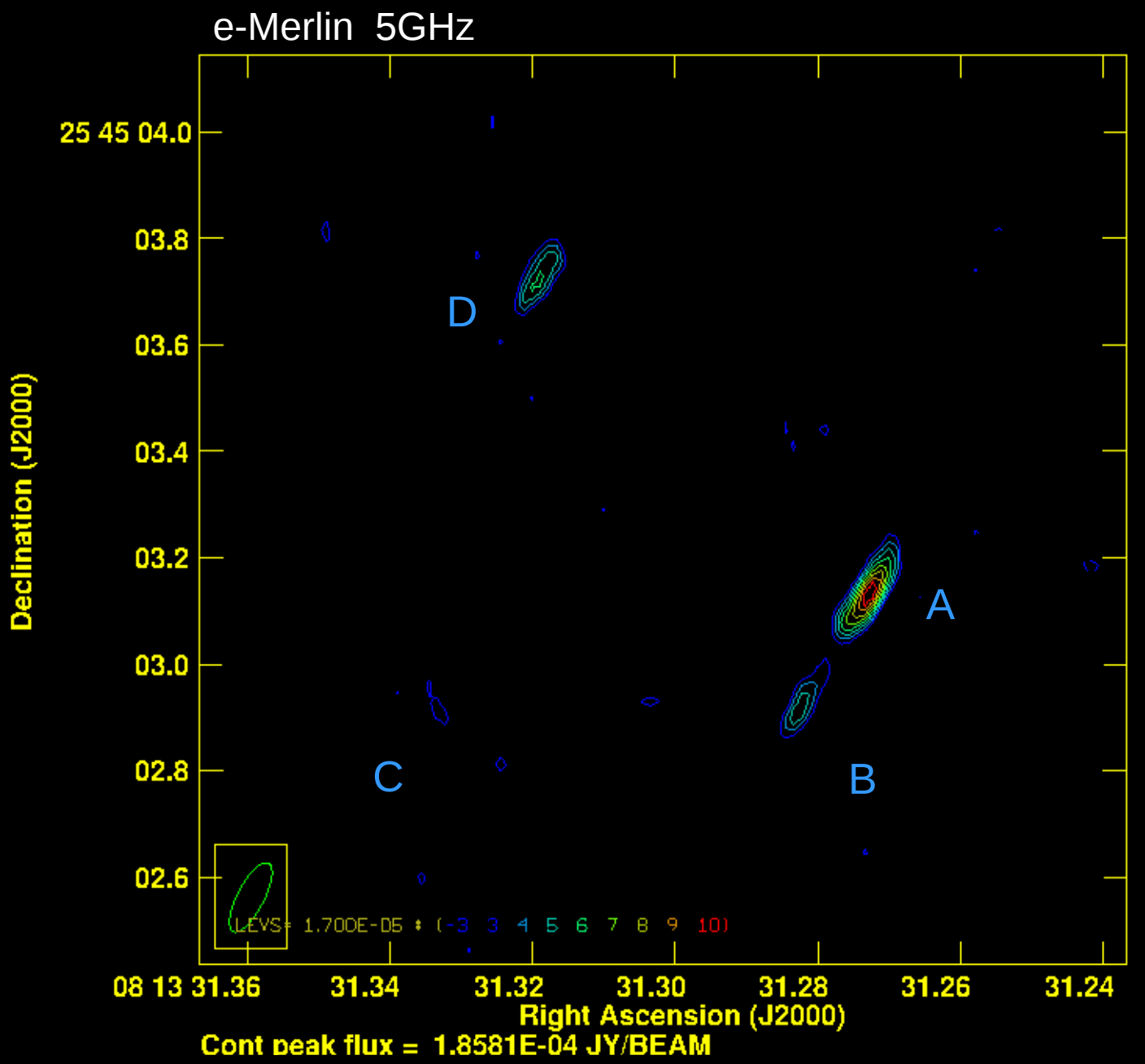
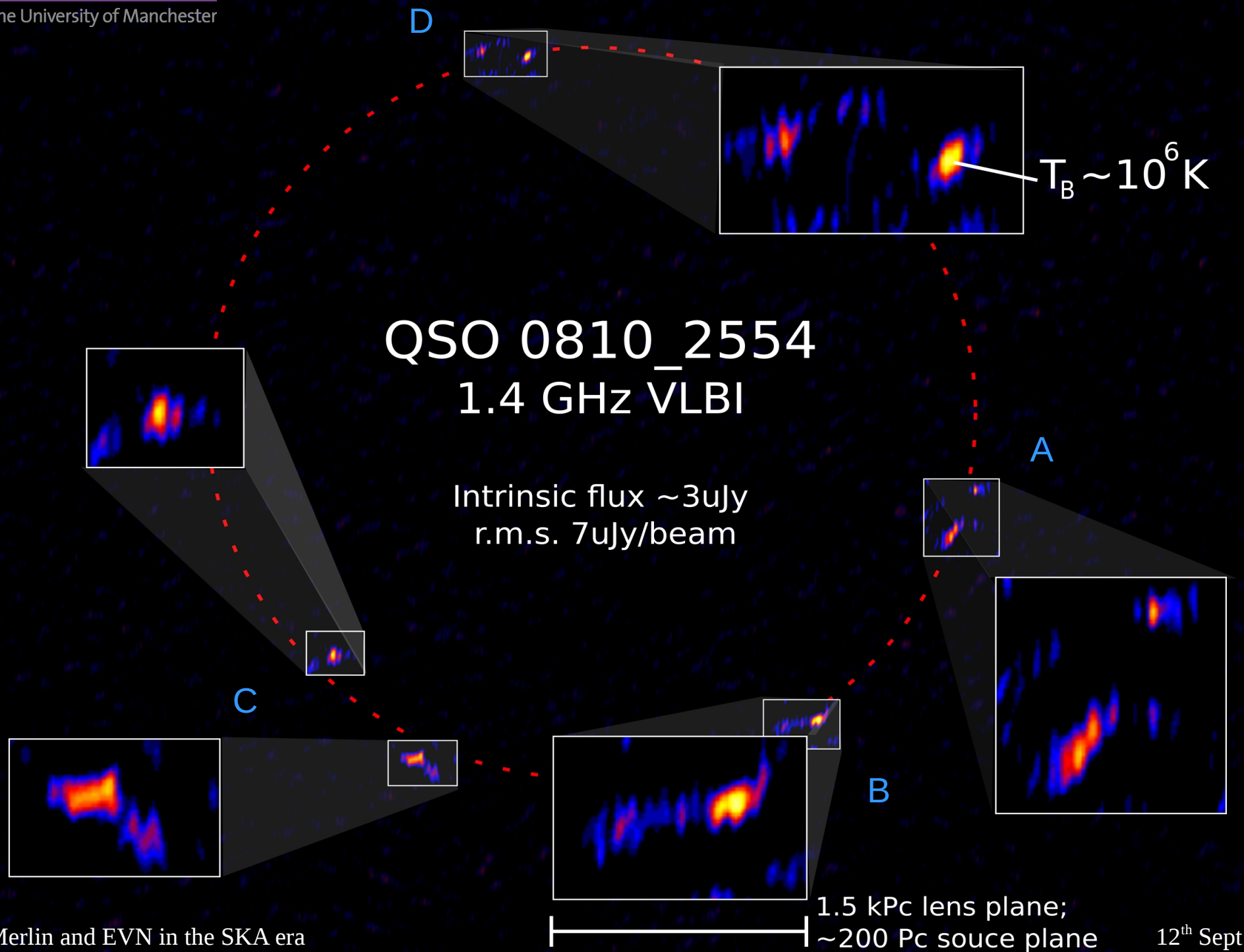
QSO 0810+2554



Hartley et al,
in prep. 2017

Hartley et al, in prep. 2017



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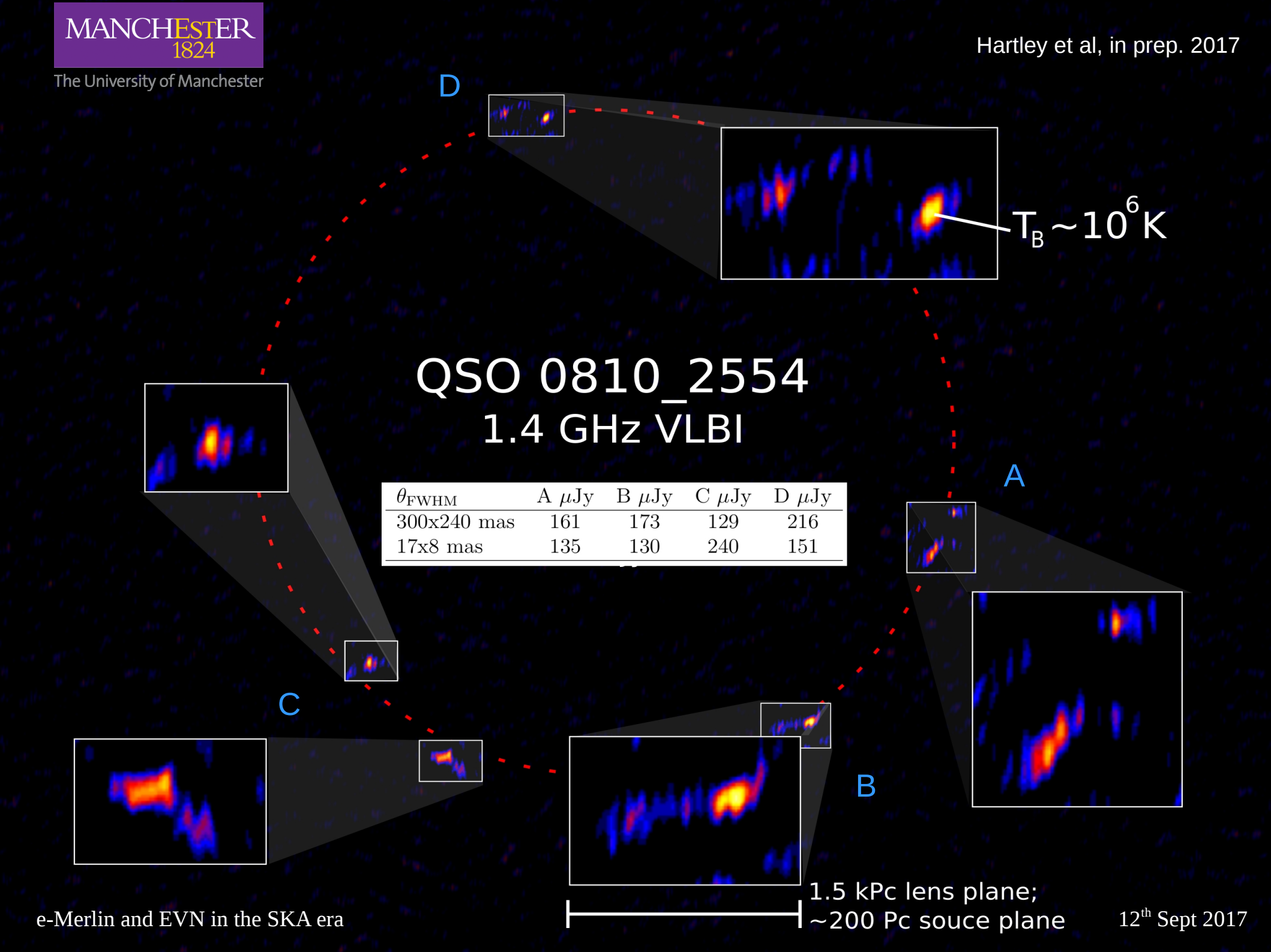
Hartley et al, in prep. 2017



$\theta_{\rm FWHM}$	A μJy	B μJy	C μJy	D μJy
300x240 mas	161	173	129	216
17x8 mas	135	130	240	151

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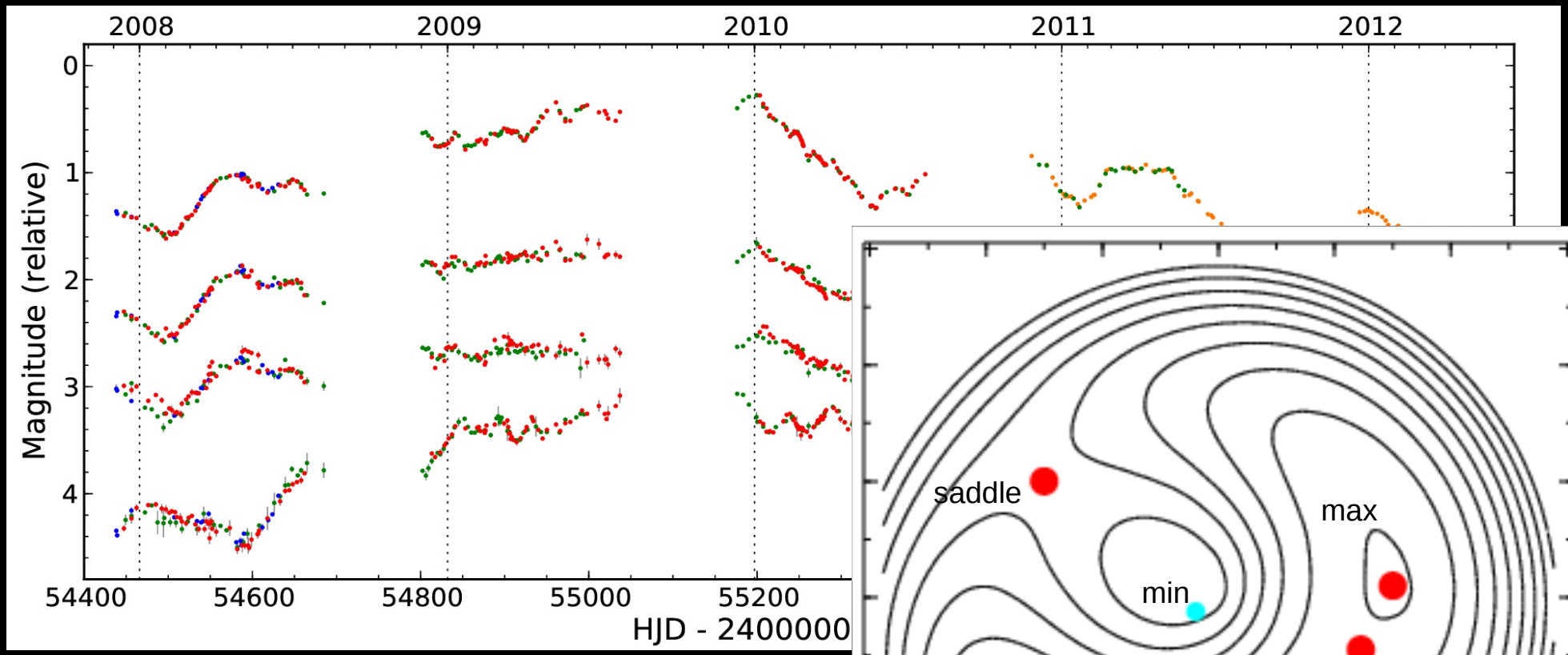
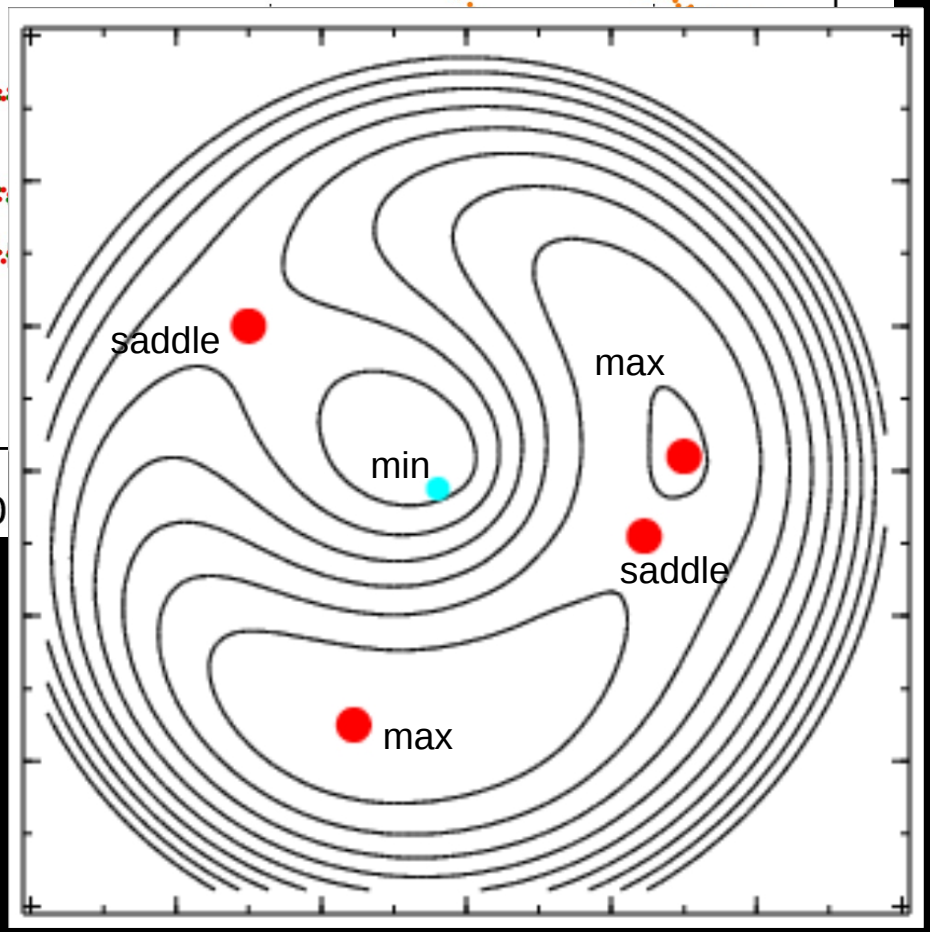
Time machines



Treu et al., 2013



Belokurov et al., 2008

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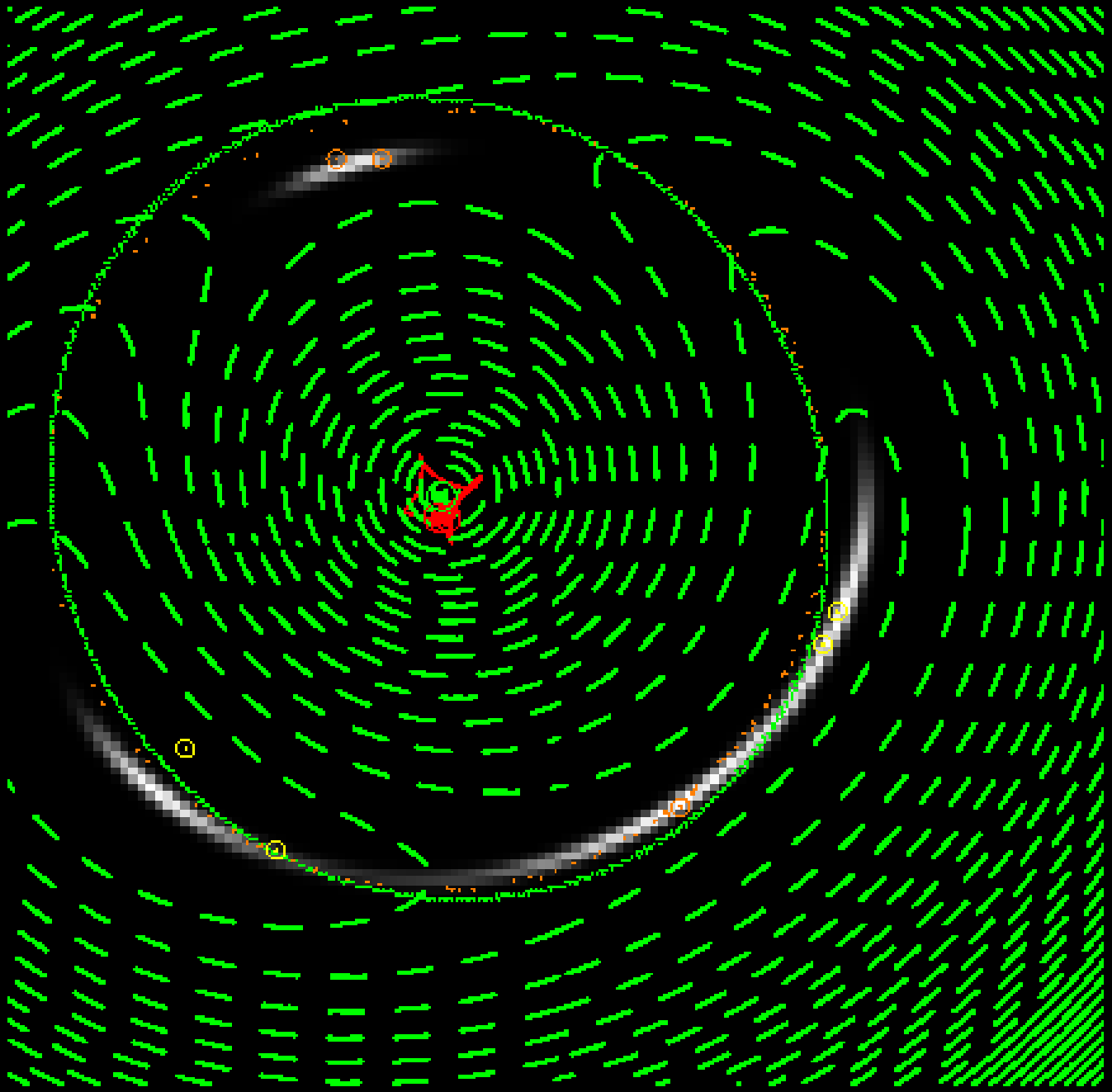
Time machines



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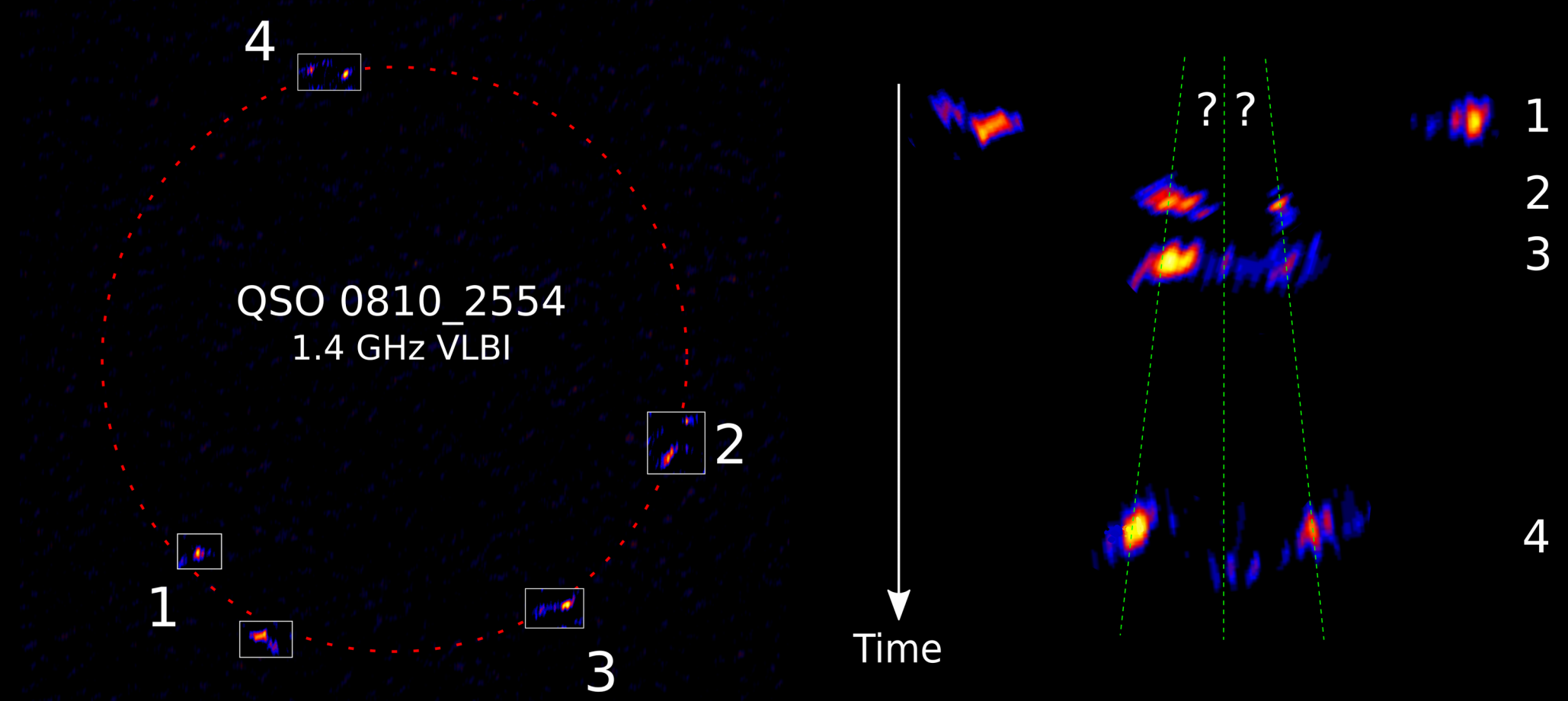
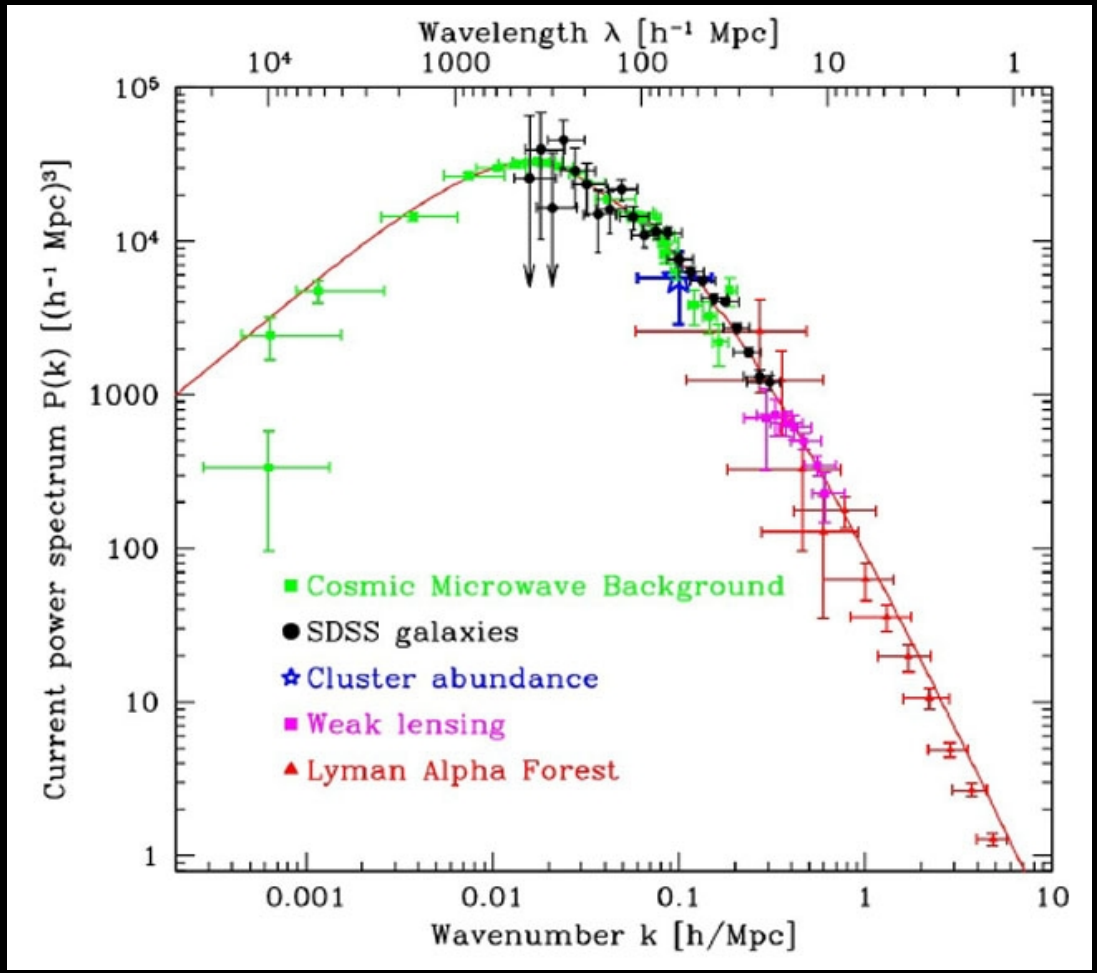
Time machines



CDM substructure?

Sub-galactic structure gives rise to image anomalies

Moore at al. 1999



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Summary

Most QSOs are ‘radio quiet’

Dominated by starburst activity or AGN?

Strong lensing allows us to see the faintest intrinsic radio emissions

High resolution and sensitivity of e-Merlin and VLBI reveal jet structure and temperatures exceeding starburst limit

Unification model?

VLBI maps of 0810+2554 hint at substructure in the lens

Exciting results and more to investigate!