

The nature of Jets in Powerful Radio Galaxies

Emmanuel Bempong-Manful

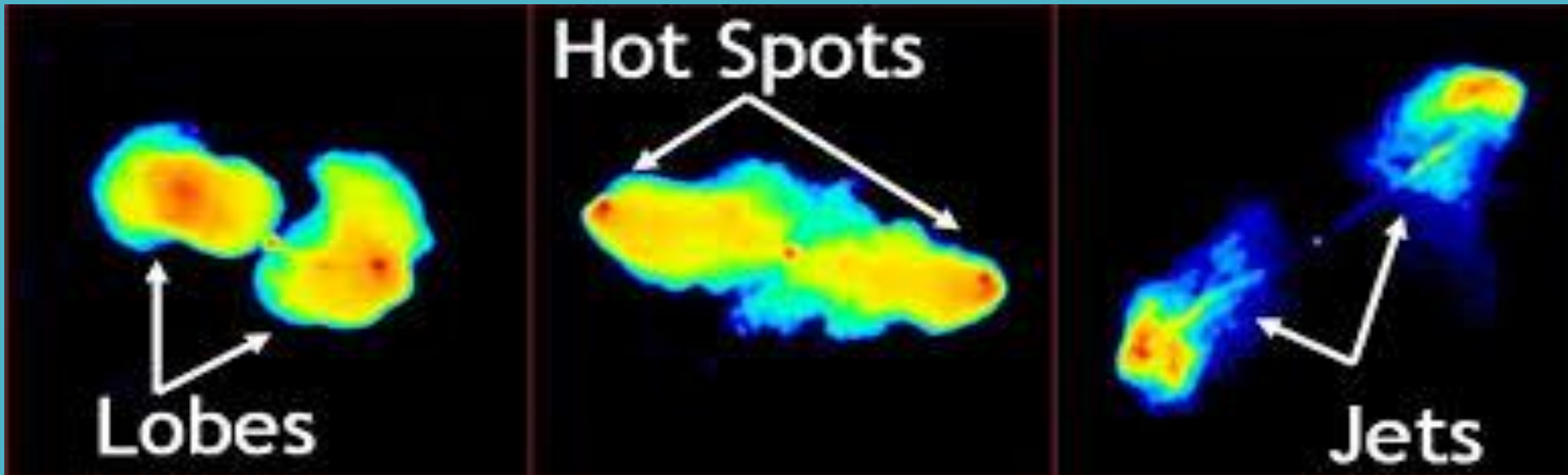
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Astrophysical Jets

- **Fast**, highly **collimated outflows** of **plasma** from compact celestial objects.
- conduits for **mass**, **momentum**, **energy** & **magnetic flux** transport (Das, 1999)



First reports

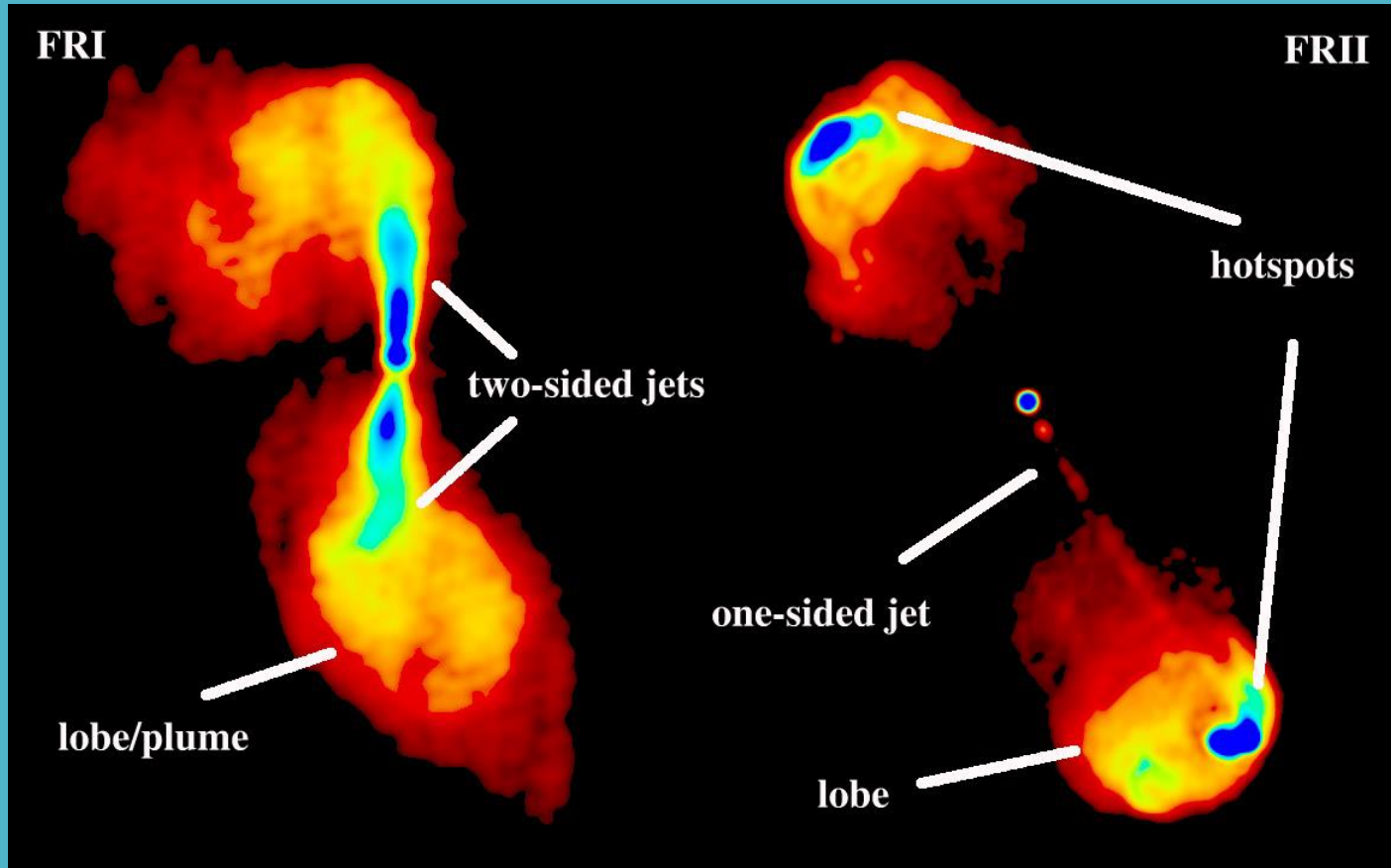


Streak of light
from **M87**

(Curtis, 1918)

Long standing **questions** => **Formation, Collimation & Acceleration** (Sikora+ 2005)

FRI & FR II Radio Jets



Division based on **stellar luminosity** of host galaxy
(Ledlow & Owen, 1996)

FR I Jets

→ decelerate from **relativistic** to **sub-relativistic** on **kpc** scales (Laing & Bridle, 2002a)

unanswered: what initiates

brightening, flaring & deceleration...???

FR II Jets

→ Remain **relativistic** until they terminate BUT less **facts** established (Laing, 1993)

current issues:

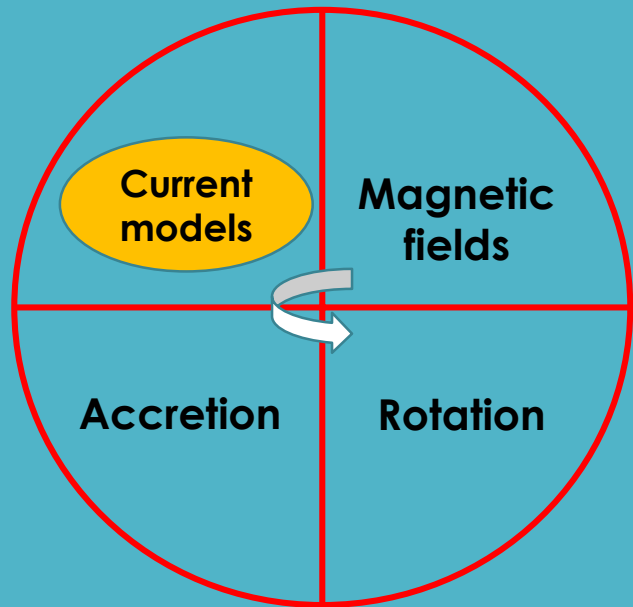
→ **inverse Compton scattering of CMB** (Celotti+ 2001)

→ **synchrotron mechanism** (Hardcastle, 2006)

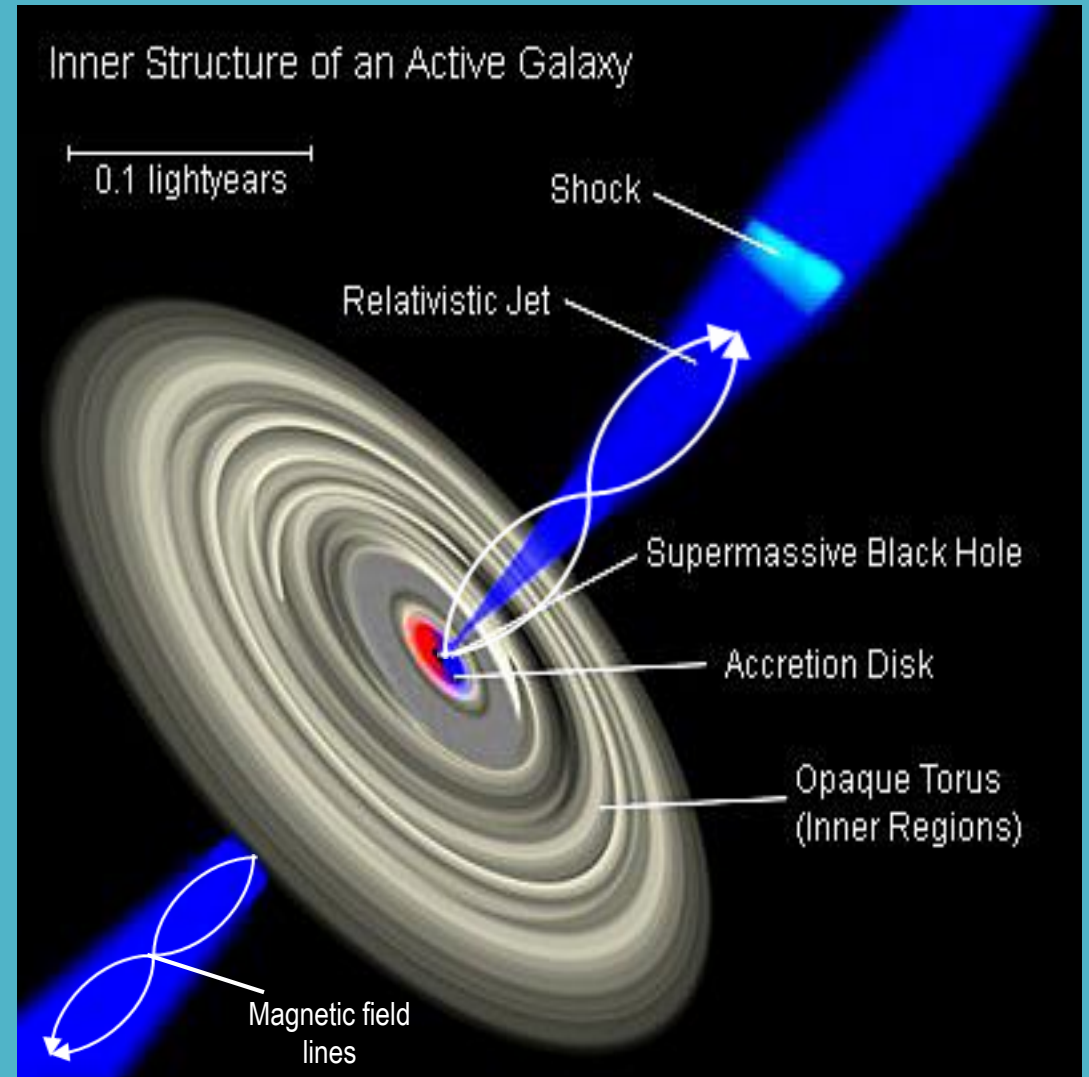


Jet Physics Models

An Observational Paradox....??

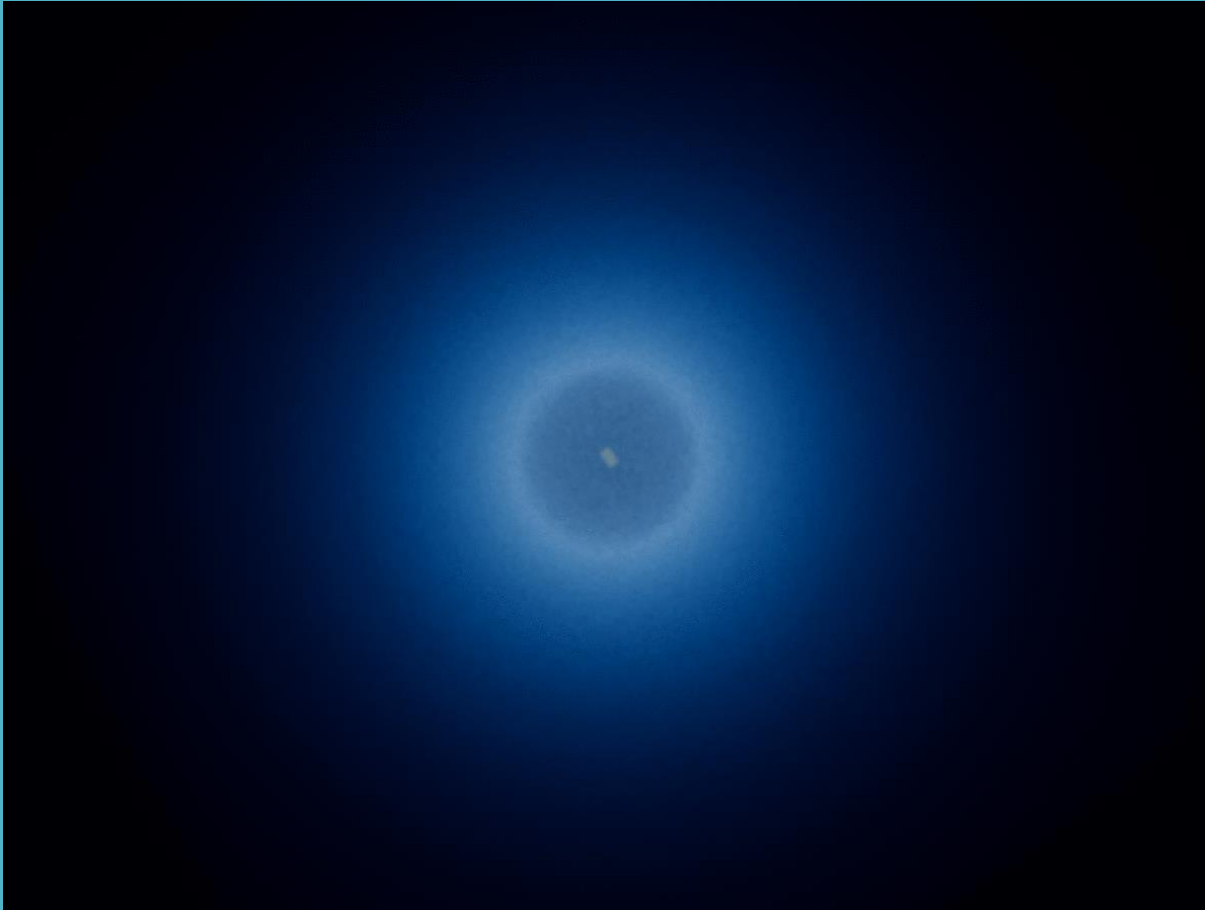


(e.g. Pudritz+ 2007)





The View from Simulations

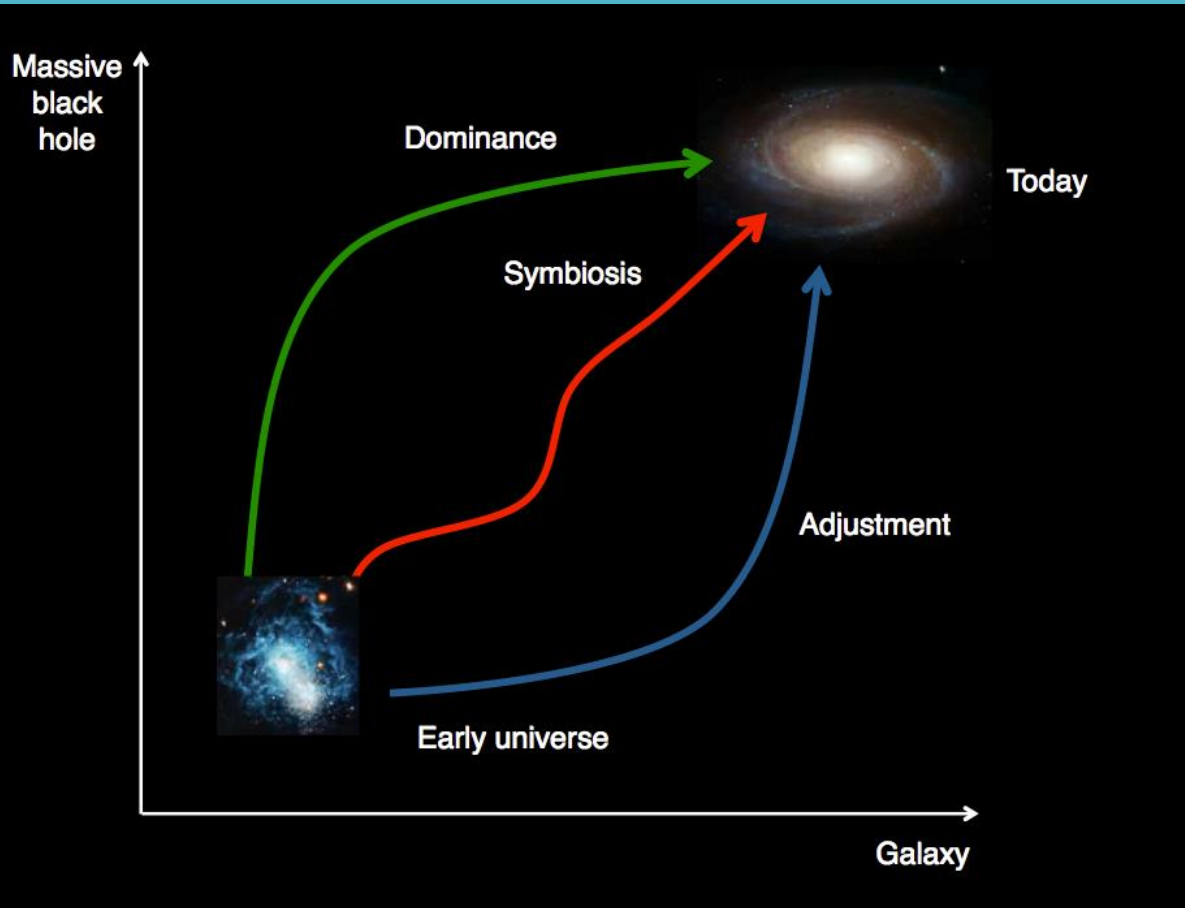


Hardcastle & Krause, 2014



Feedback, Structure & B-H Growth

Galaxy formation = merger + gas accretion
(Di Matteo+ 2005)



AGN Feedback Cycle

efficient coupling to ISM/IGM (Tadhunter, 2008)

inject energy into large-scale IGM (Birzan+ 2008)

constructive & destructive (Morganti+ 2010)

structure properties || galaxy bulge || SMBH masses

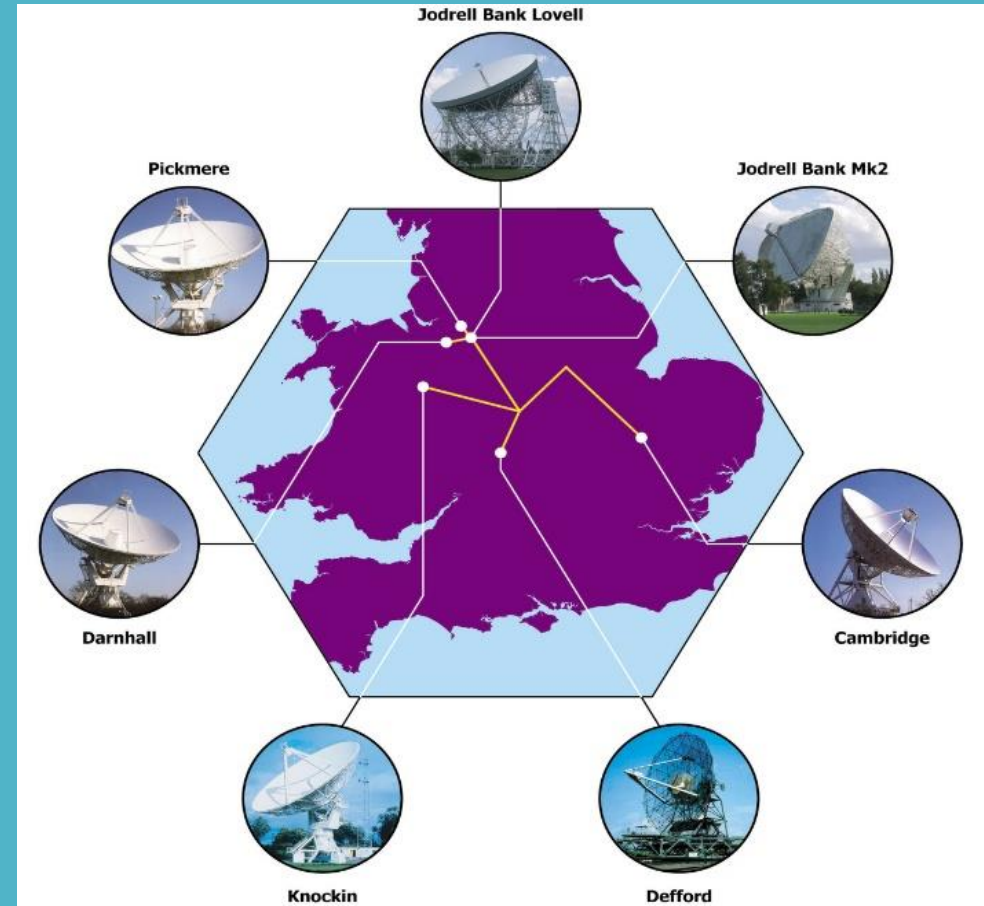
Radio Observations

VLA



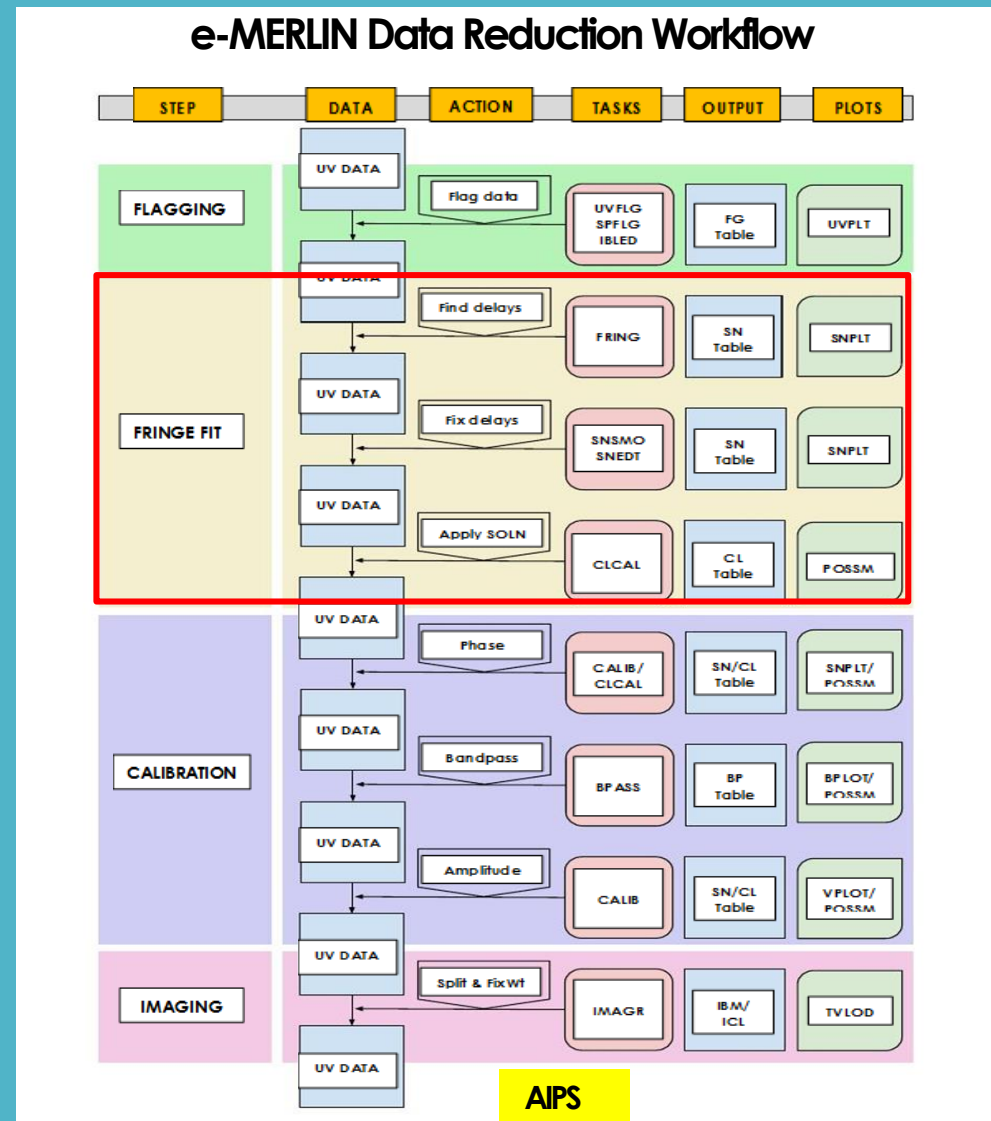
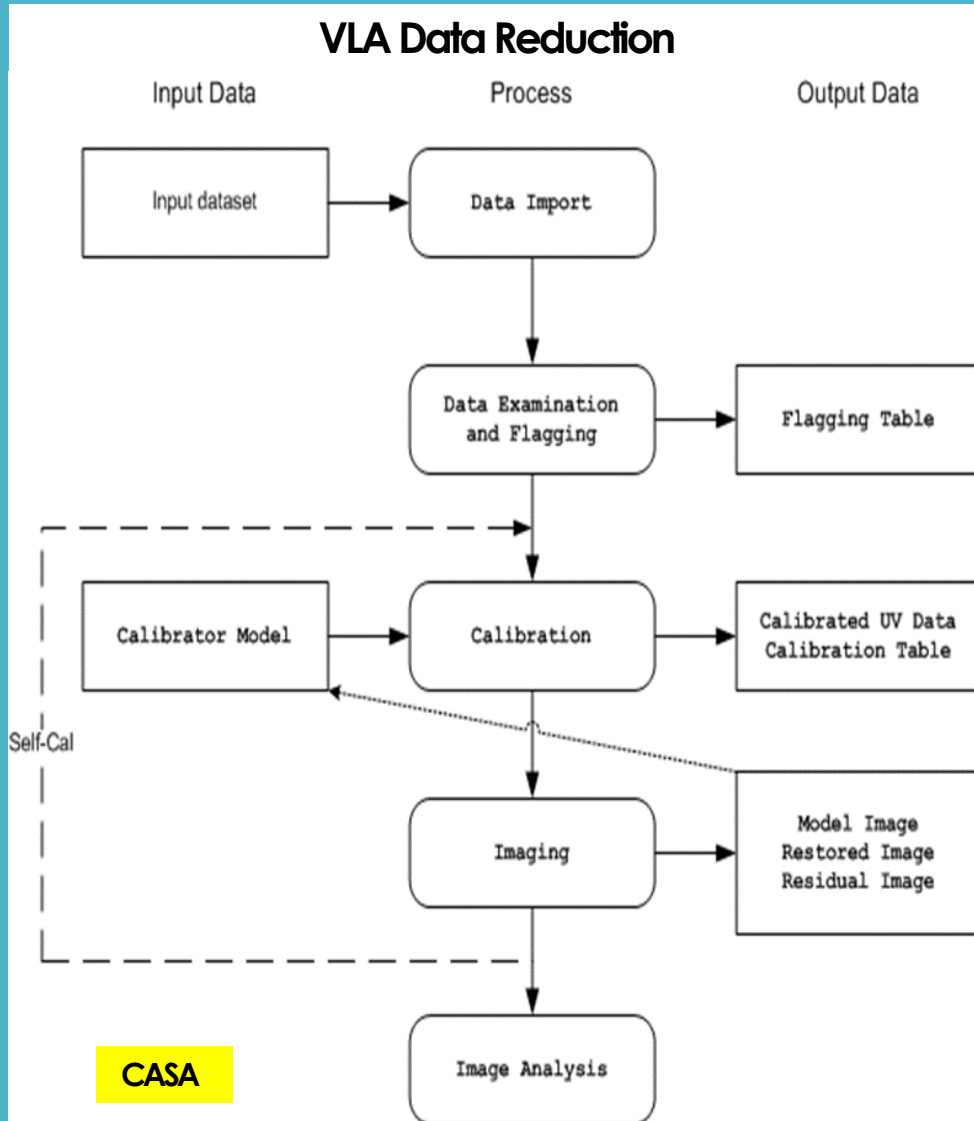
Overall view of the VLA, looking South
(Credit: Dave Finley, NRAO/AUI)

e-MERLIN



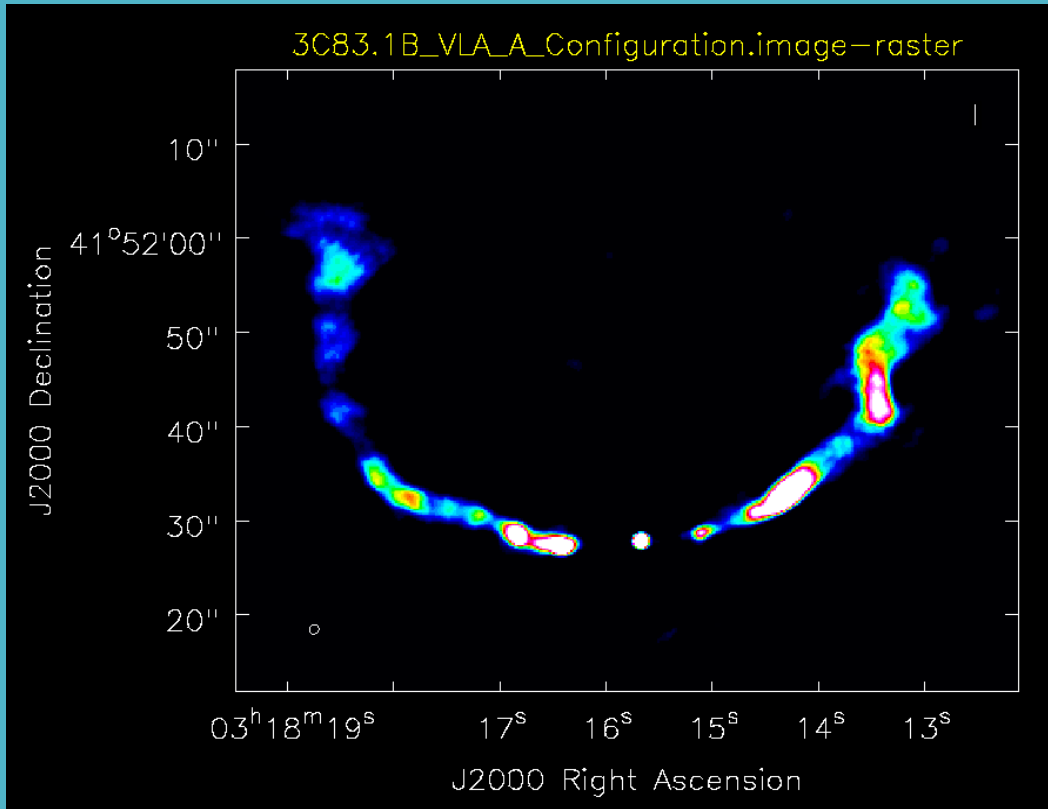
Location map of all the e-MERLIN telescopes in the UK
(Credit: University of Manchester)

Data Reduction

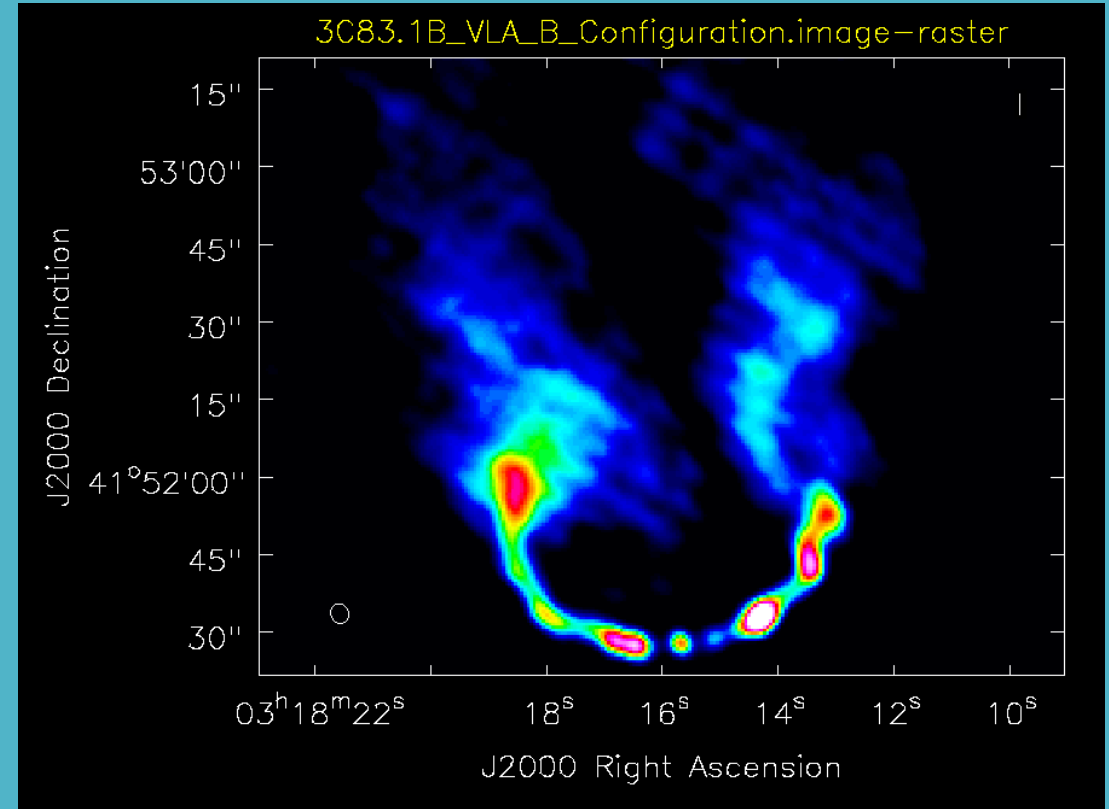




Total Intensity Maps



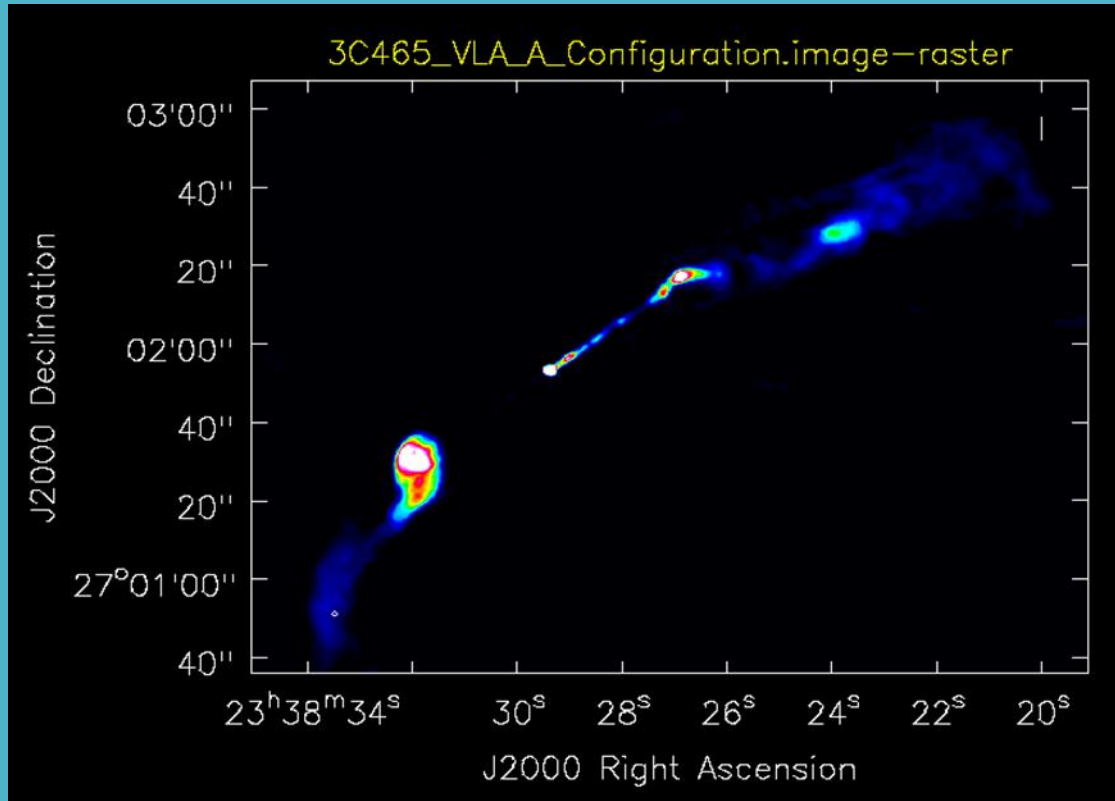
L-Band, **1.1×1.0"** resolution
A-Configuration VLA map



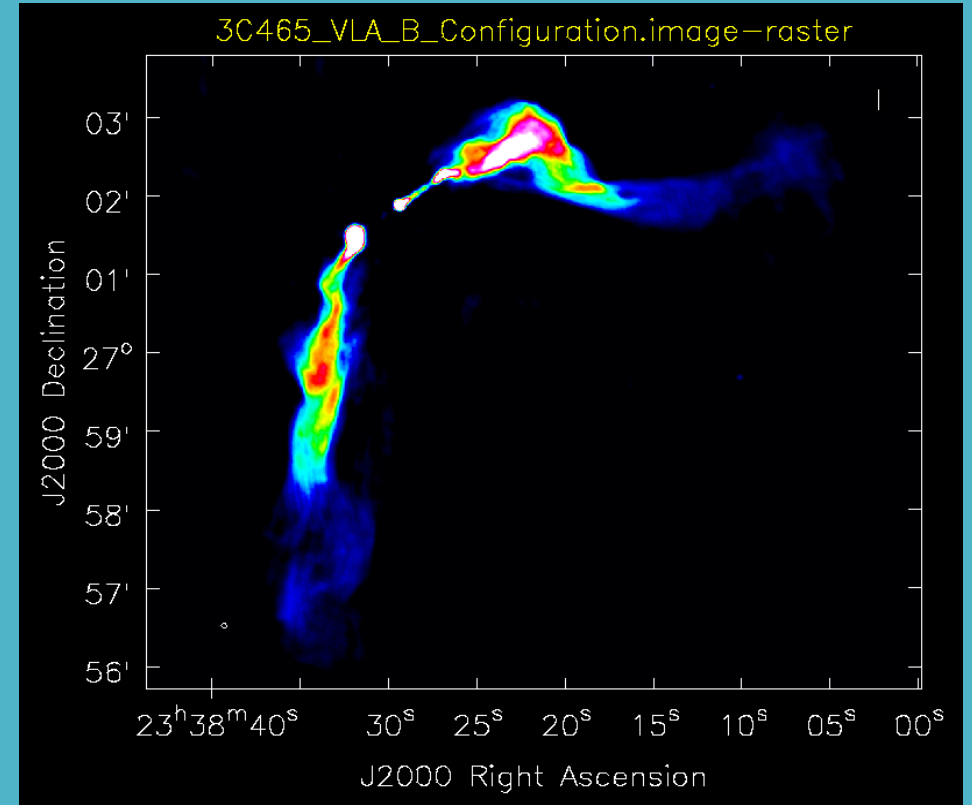
L-Band, **3.7×3.2"** resolution
B-Configuration VLA map



Total Intensity Maps



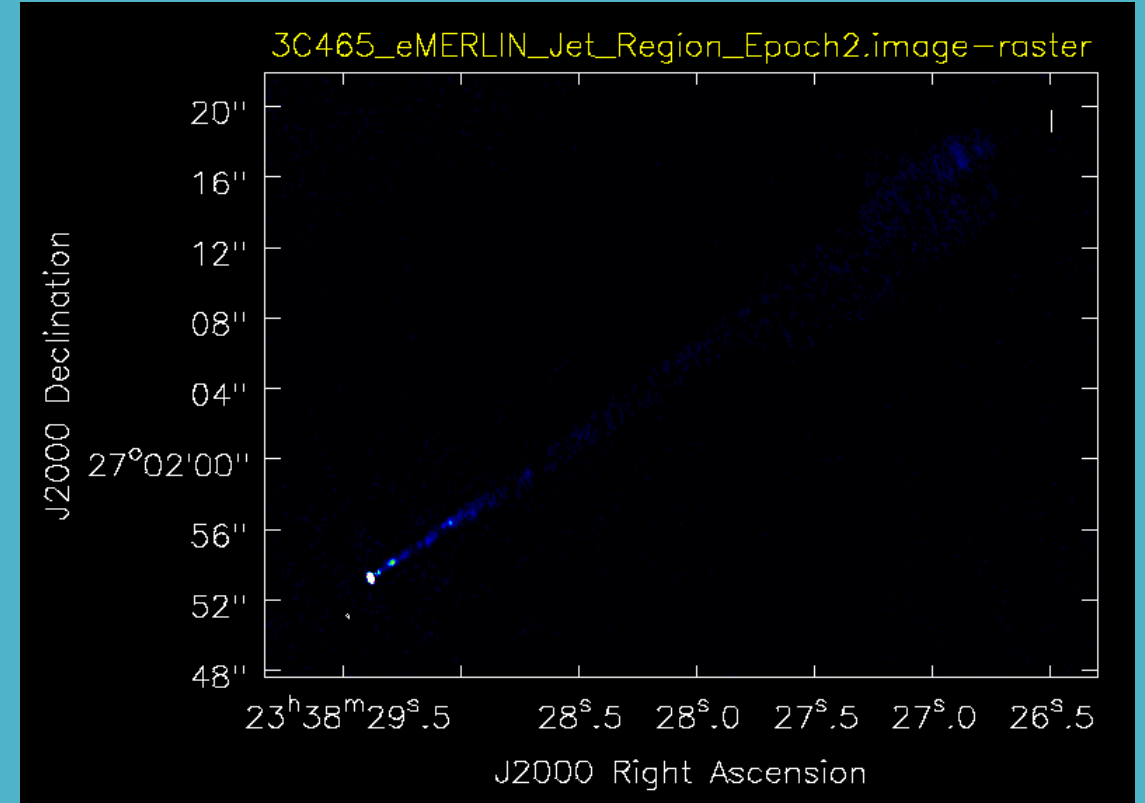
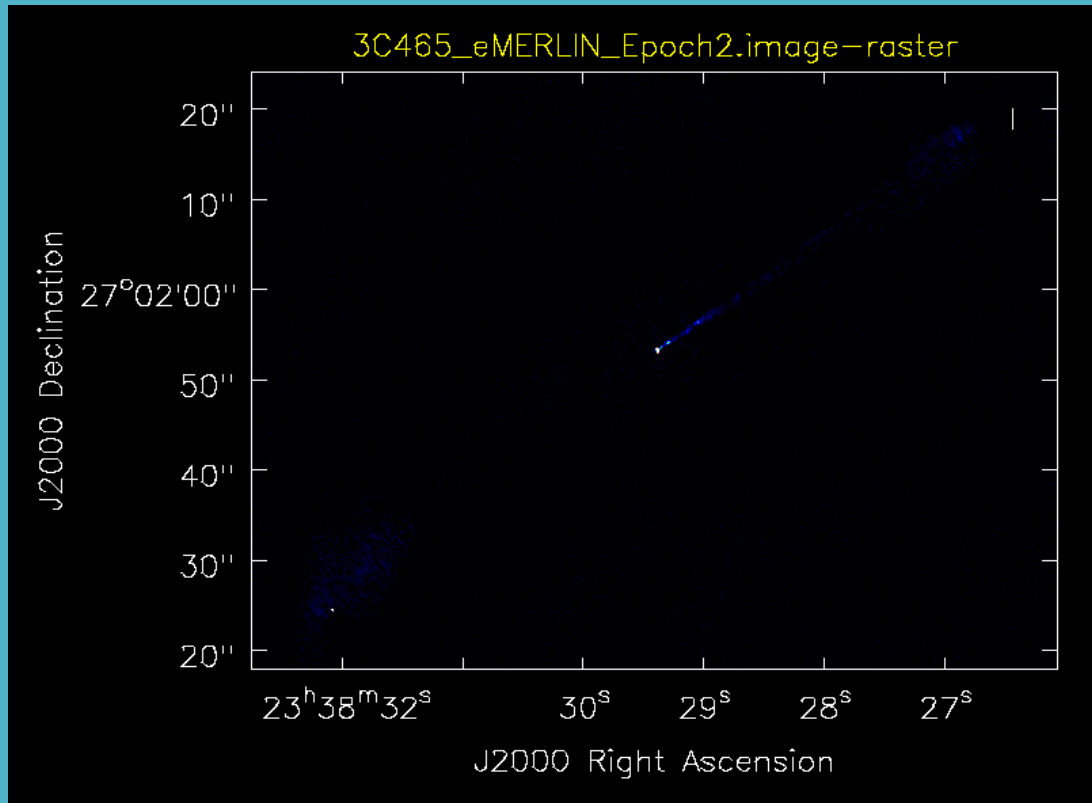
L-Band, **1.5×1.2''** resolution
A-Configuration VLA map



L-Band, **3.9×3.6''** resolution
B-Configuration VLA map

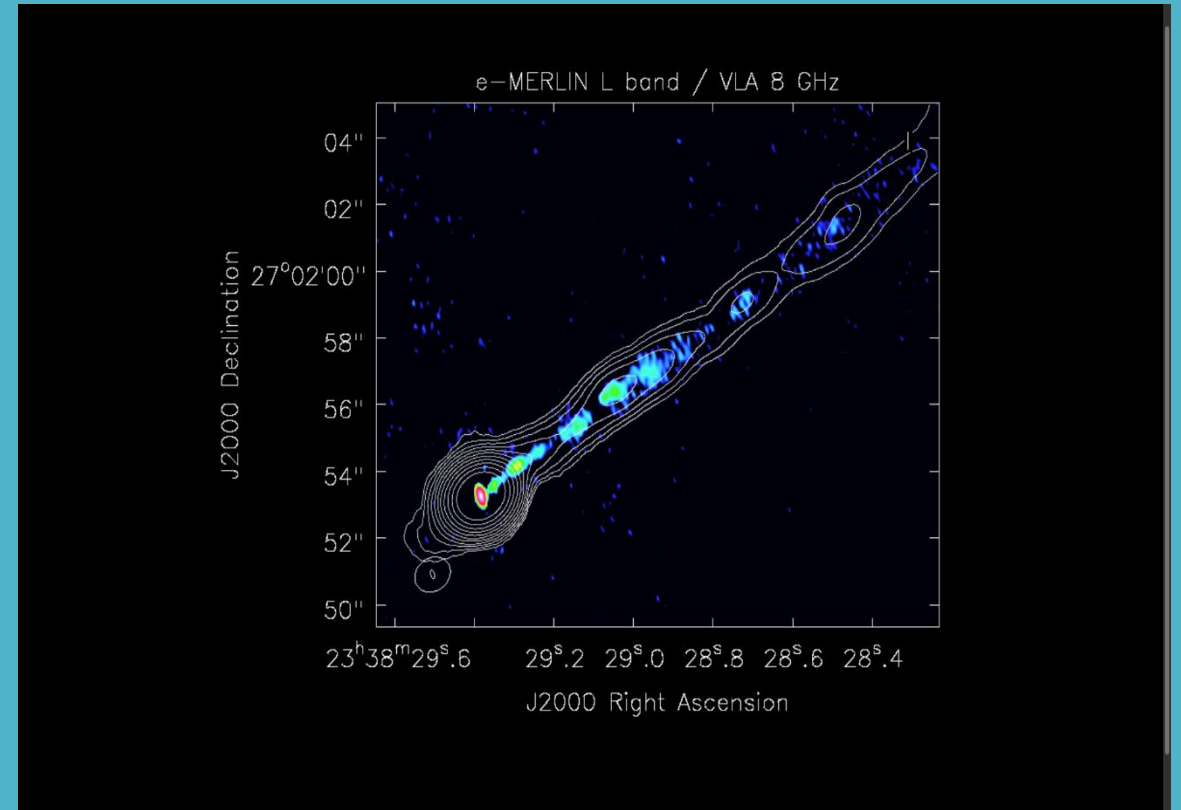
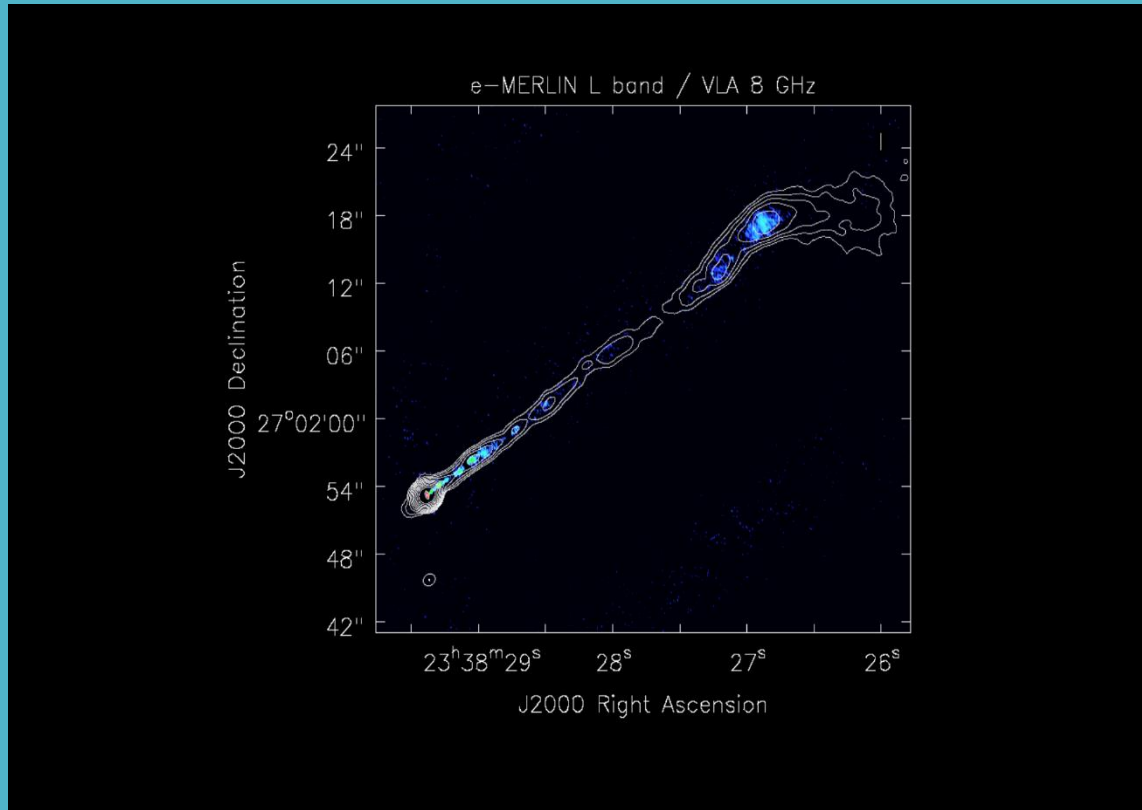


Total Intensity Maps



L-Band, **0.3×0.1"** resolution e-MERLIN map

Total Intensity Maps



L-Band, **0.3×0.1"** resolution e-MERLIN map
Overlaid contour of **0.5"** resolution 8GHz VLA map



Next Steps...

- Construction of Total Intensity maps
 - 3C83.1B (**e-MERLIN**)
 - *science targets* (**VLA** + **e-MERLIN**)

- Polarization & Spectral Index imaging
 - *science targets* (**VLA** + **e-MERLIN**)

- Jet Physics Analysis
 - jet dynamics in AGNs (sub-kpc scales)
 - jet particle acceleration
 - magnetic field influence



Acknowledgement



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|| | Dr. Javier Moldon





Thank you...