

A photograph of a radio telescope array, likely the Very Large Array, featuring several large parabolic dish antennas mounted on pedestals. The scene is set against a twilight sky with soft clouds, and the foreground shows a dark, grassy field.

D. JACOBS
SES 598

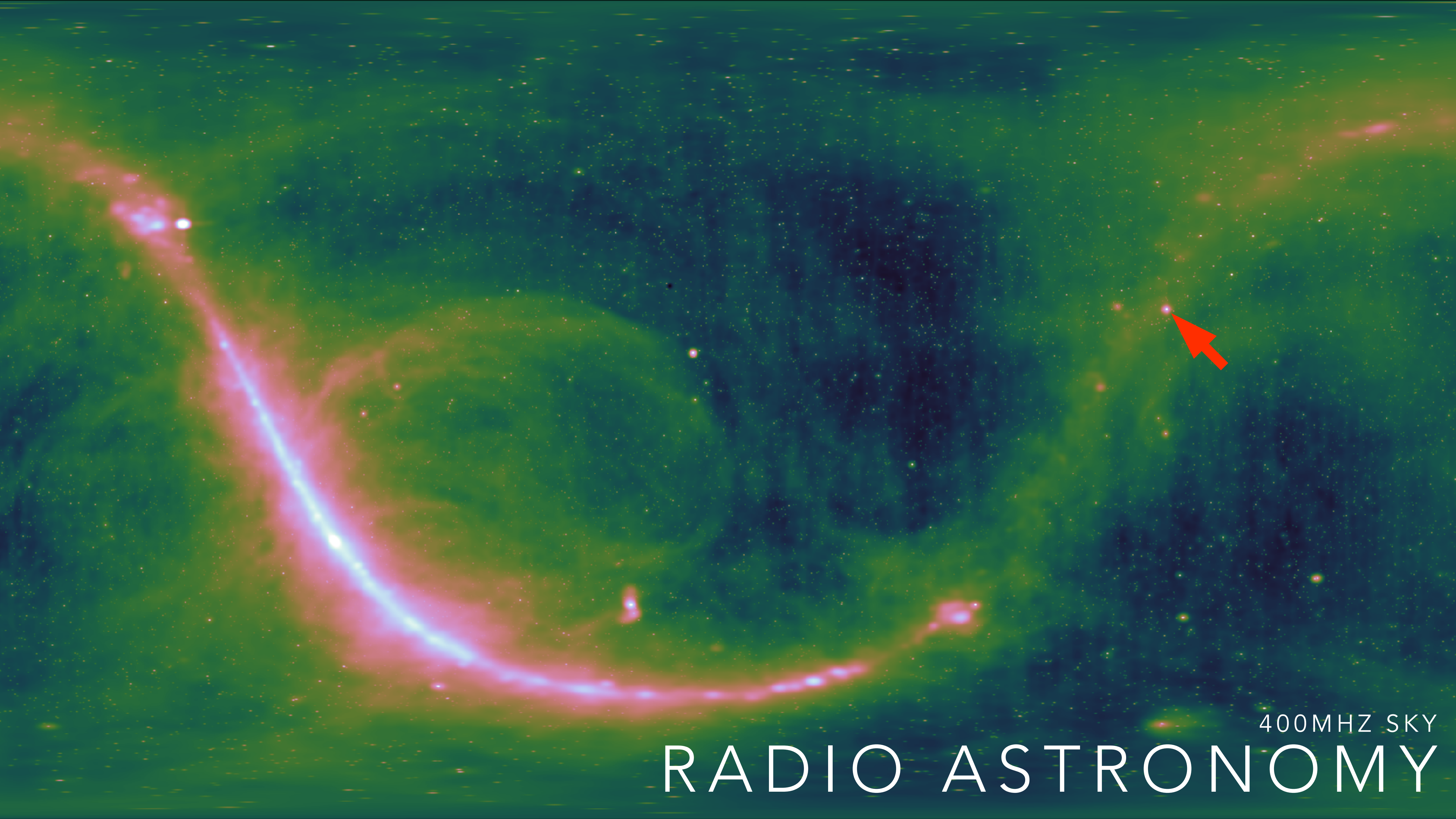
RADIO ASTRONOMY LECTURE 2

GREEN BANK, WV

RADIO ASTRONOMY

SKY MAP WITH 300' AT 4.85 GHZ

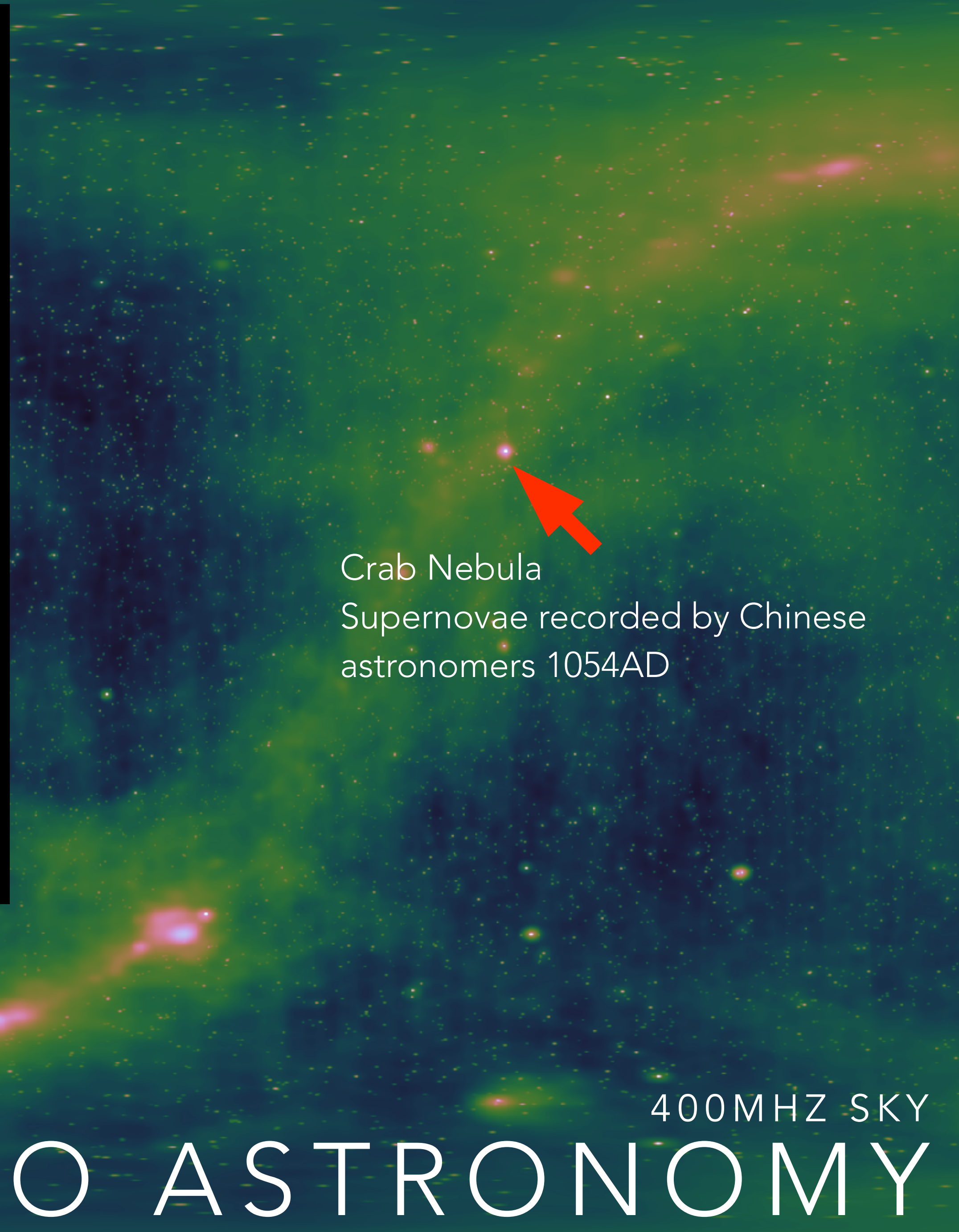
CONDON ET AL



400MHz SKY
RADIO ASTRONOMY



VLA 5GHz

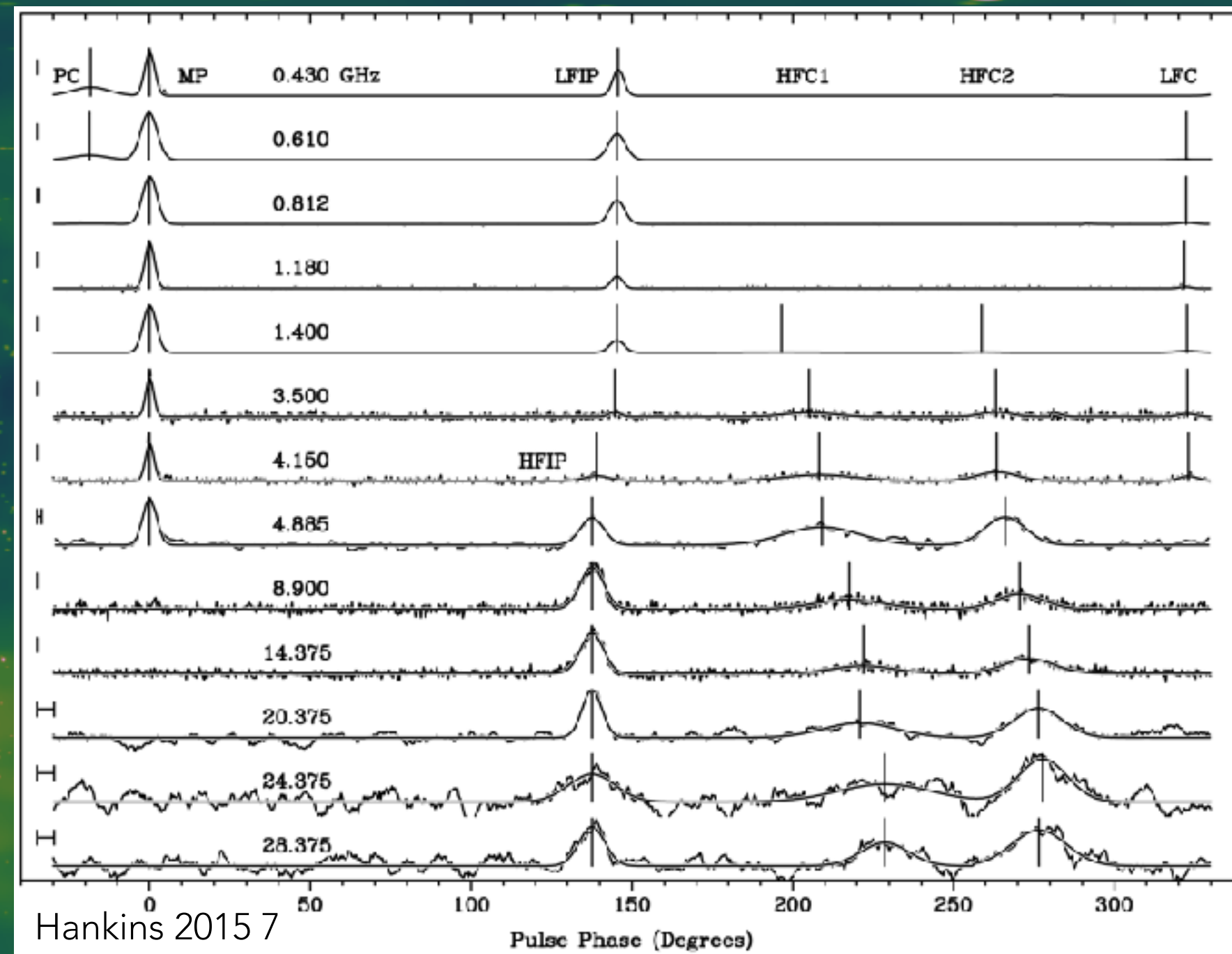


Crab Nebula
Supernovae recorded by Chinese
astronomers 1054AD

400MHz SKY

RADIO ASTRONOMY

VLA 5GHz

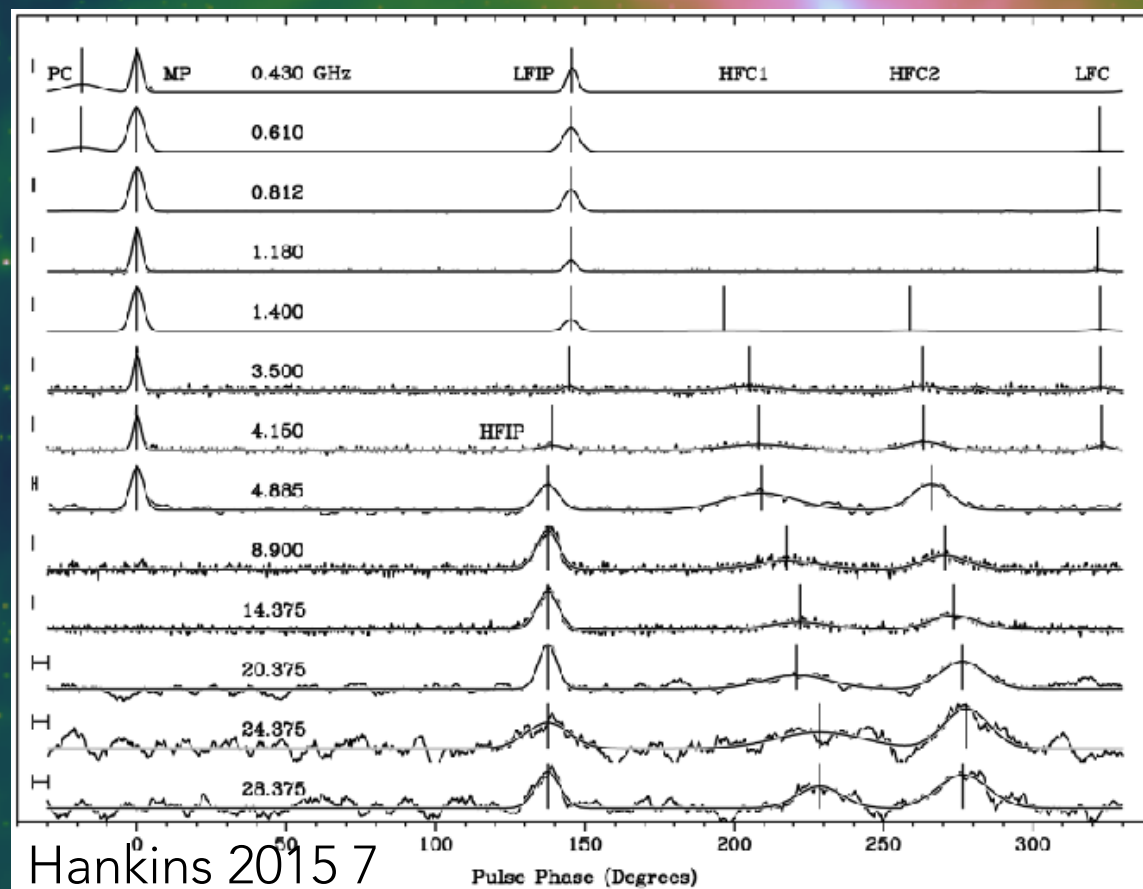


33ms pulsar detected at Arecibo

400MHz SKY
RADIO ASTRONOMY

But wait theres more...

VLA, 5GHz



33ms pulsar detected at Arecibo

Chandra, Xrays

The brightest X-ray source in the sky.

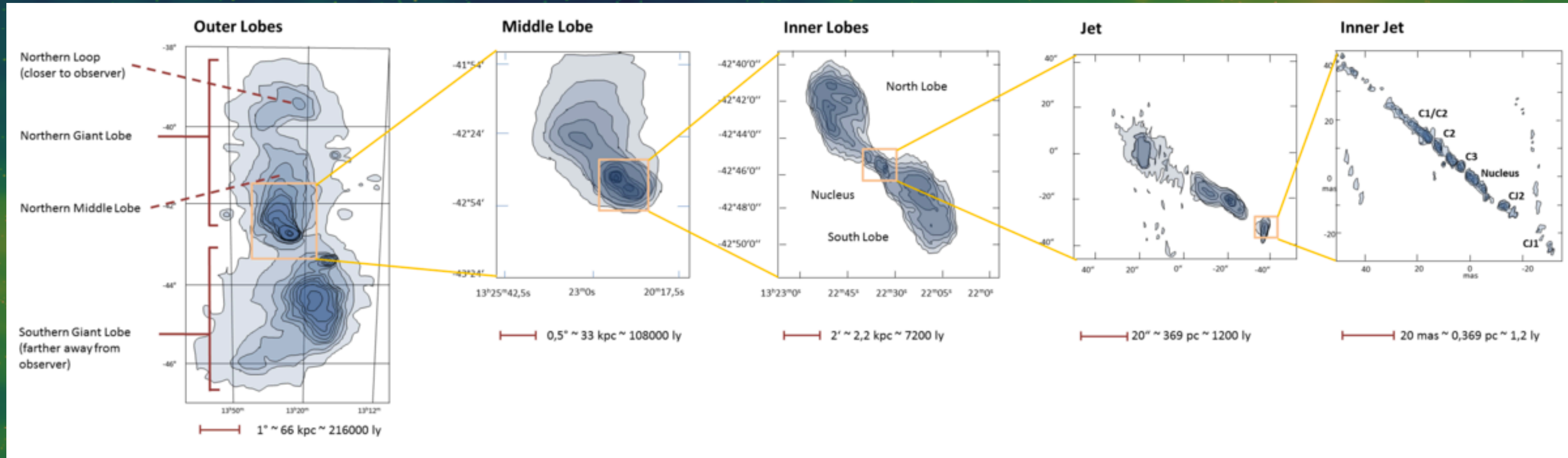
400MHz SKY
RADIO ASTRONOMY

Note Moon for scale



ATCA 5Ghz

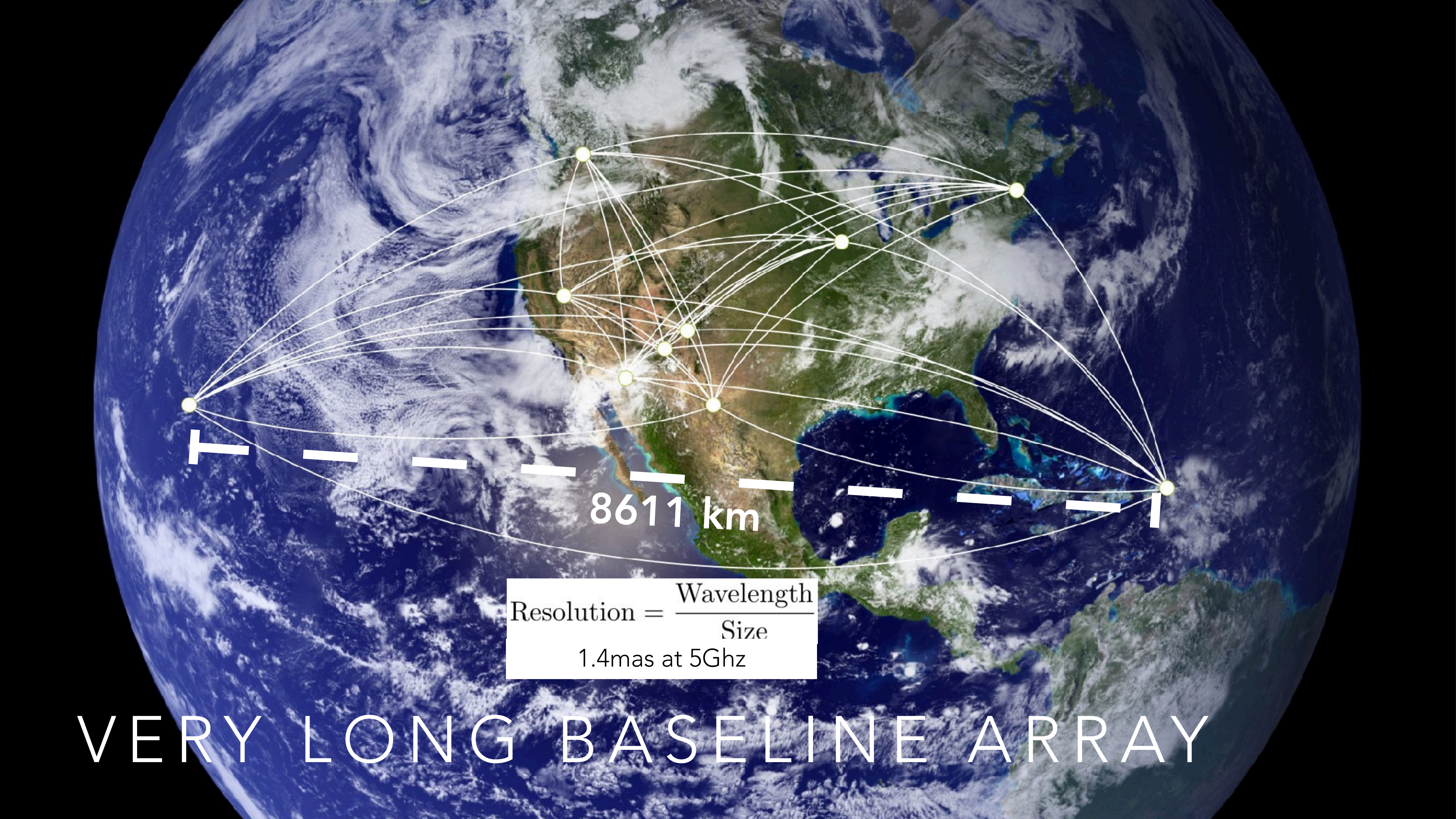
600 kpc
Compare: Distance to Andromeda 800kpc



VLBI



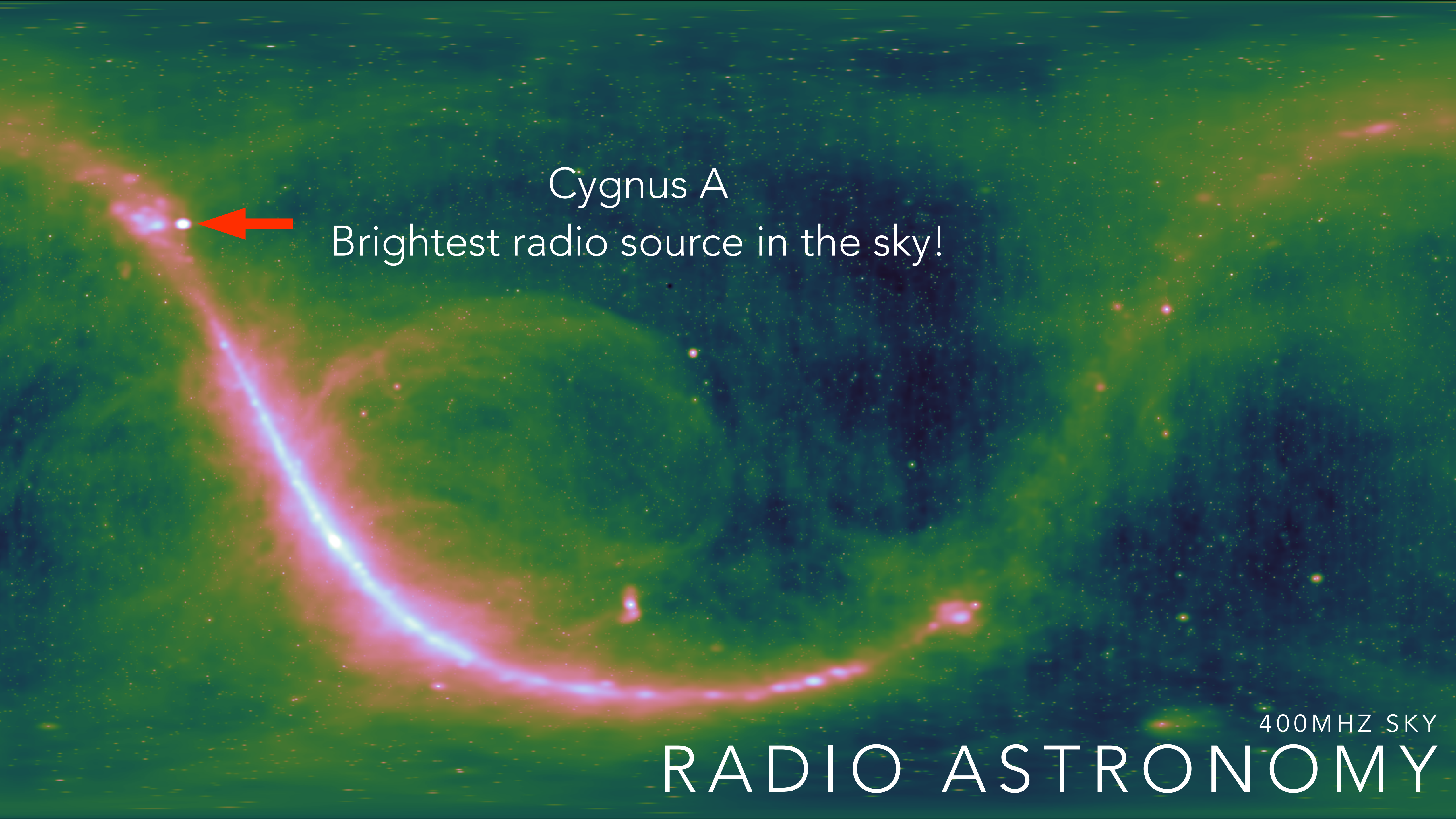
400MHz SKY
RADIO ASTRONOMY



$$\text{Resolution} = \frac{\text{Wavelength}}{\text{Size}}$$

1.4mas at 5Ghz

VERY LONG BASELINE ARRAY

A false-color radio sky map at 400 MHz. The background is a dark greenish-blue, speckled with numerous small, faint white and yellow dots representing distant radio sources. A prominent, bright, curved feature in shades of magenta and pink arcs across the lower half of the image. In the upper left, a small, bright, multi-lobed source is highlighted by a red arrow pointing towards it from the right.

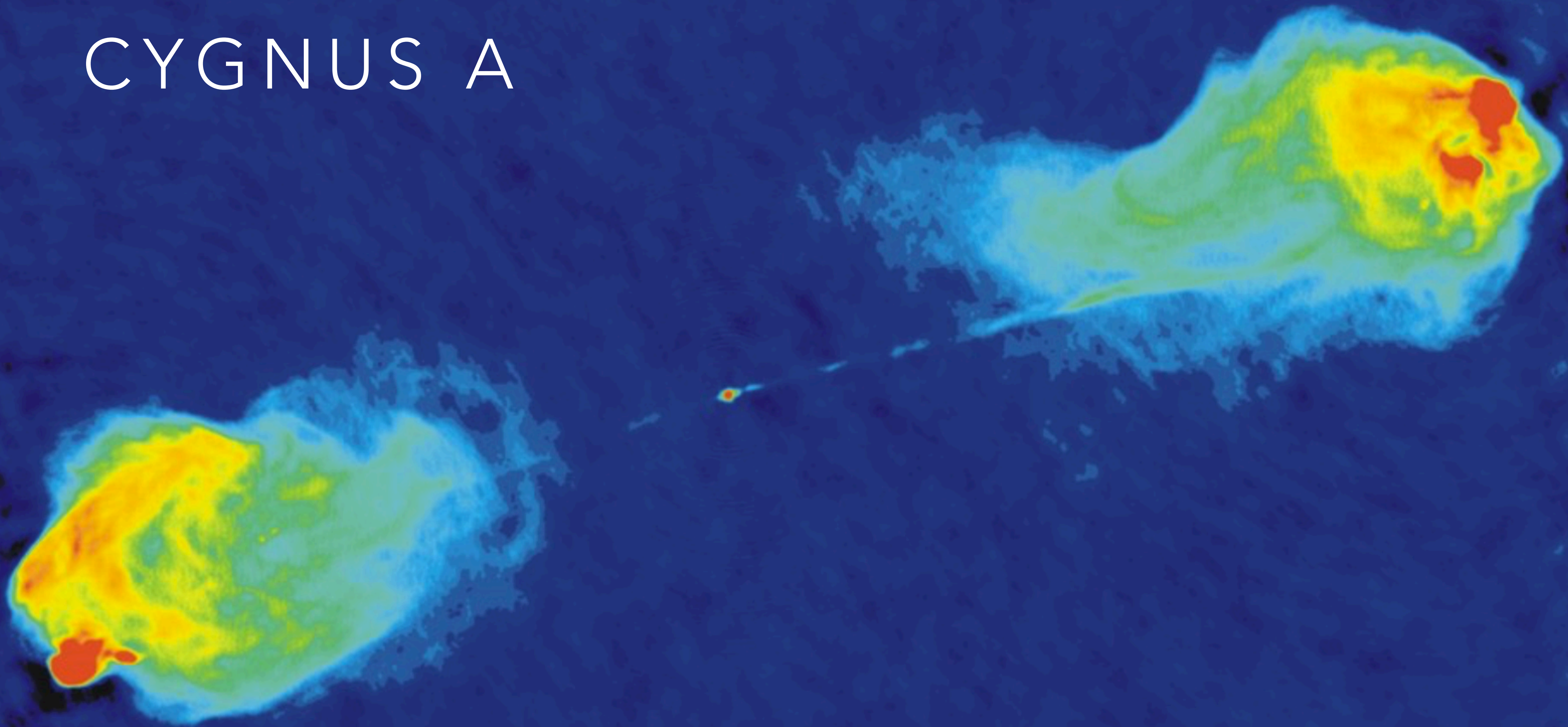
Cygnus A

Brightest radio source in the sky!

400MHz SKY

RADIO ASTRONOMY

CYGNUS A



Carilli et al

RADIO GALAXIES

LOTS OF THESE GUYS

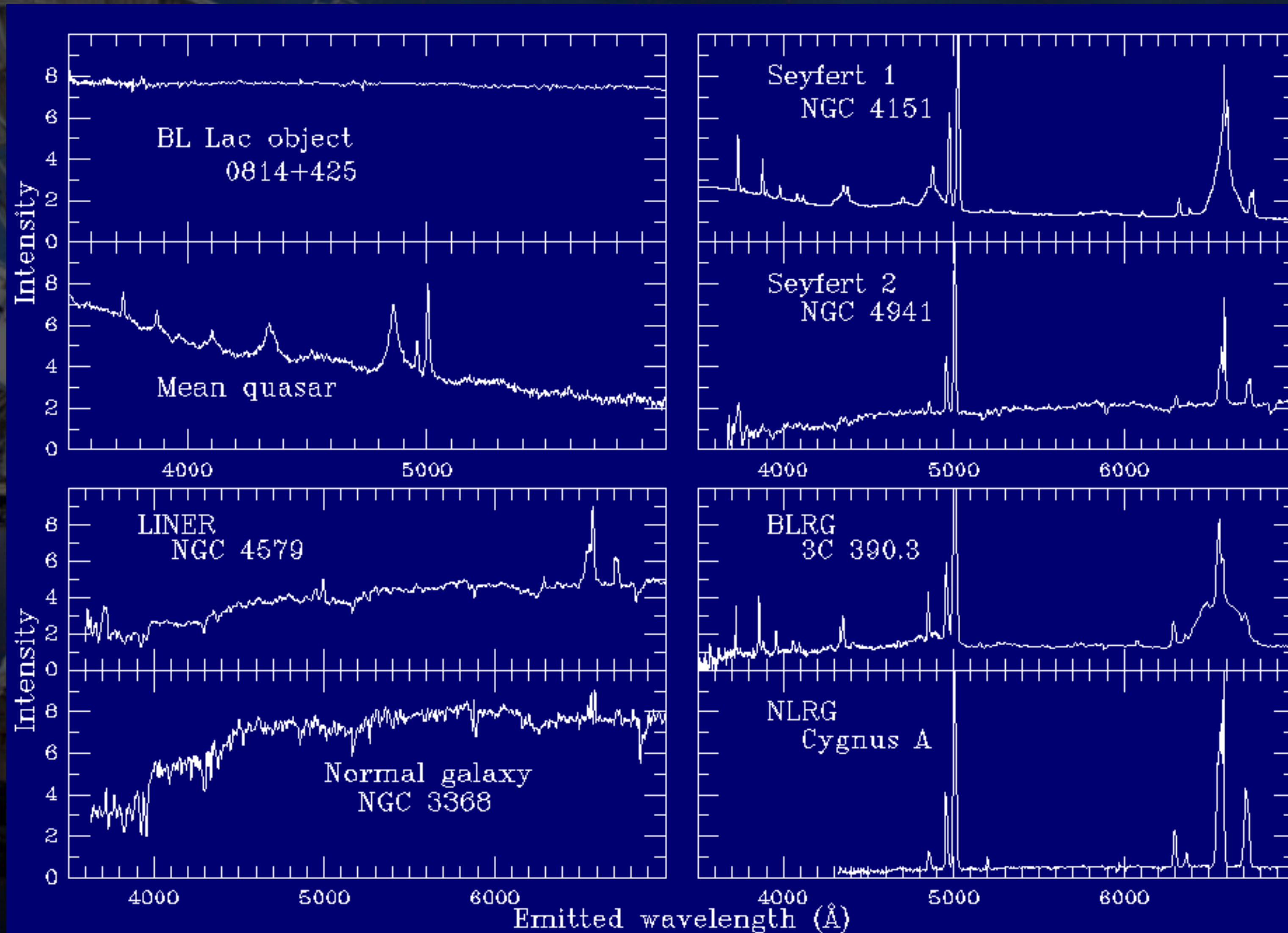
VISIBLE IN THE OPTICAL TOO!

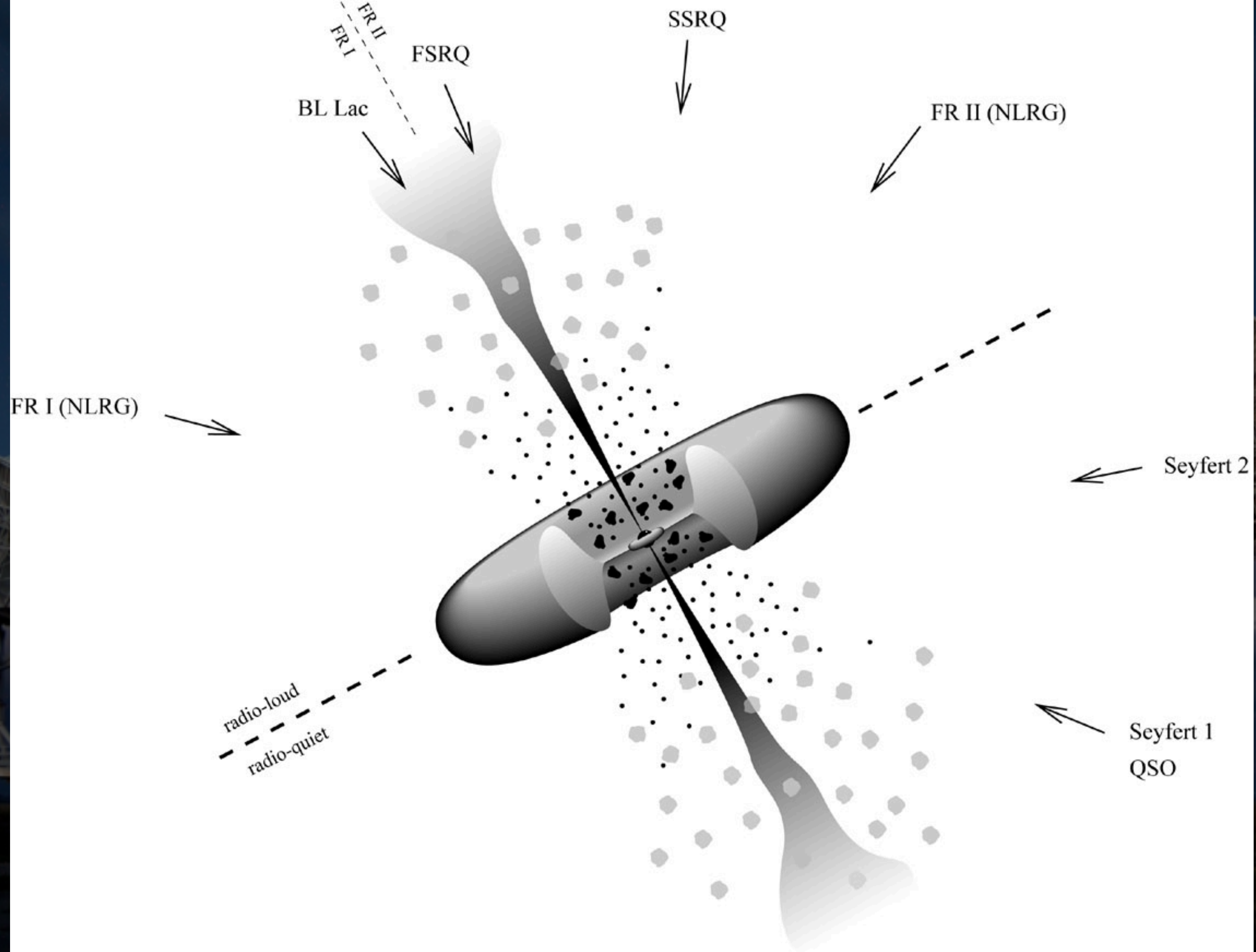
3C 273

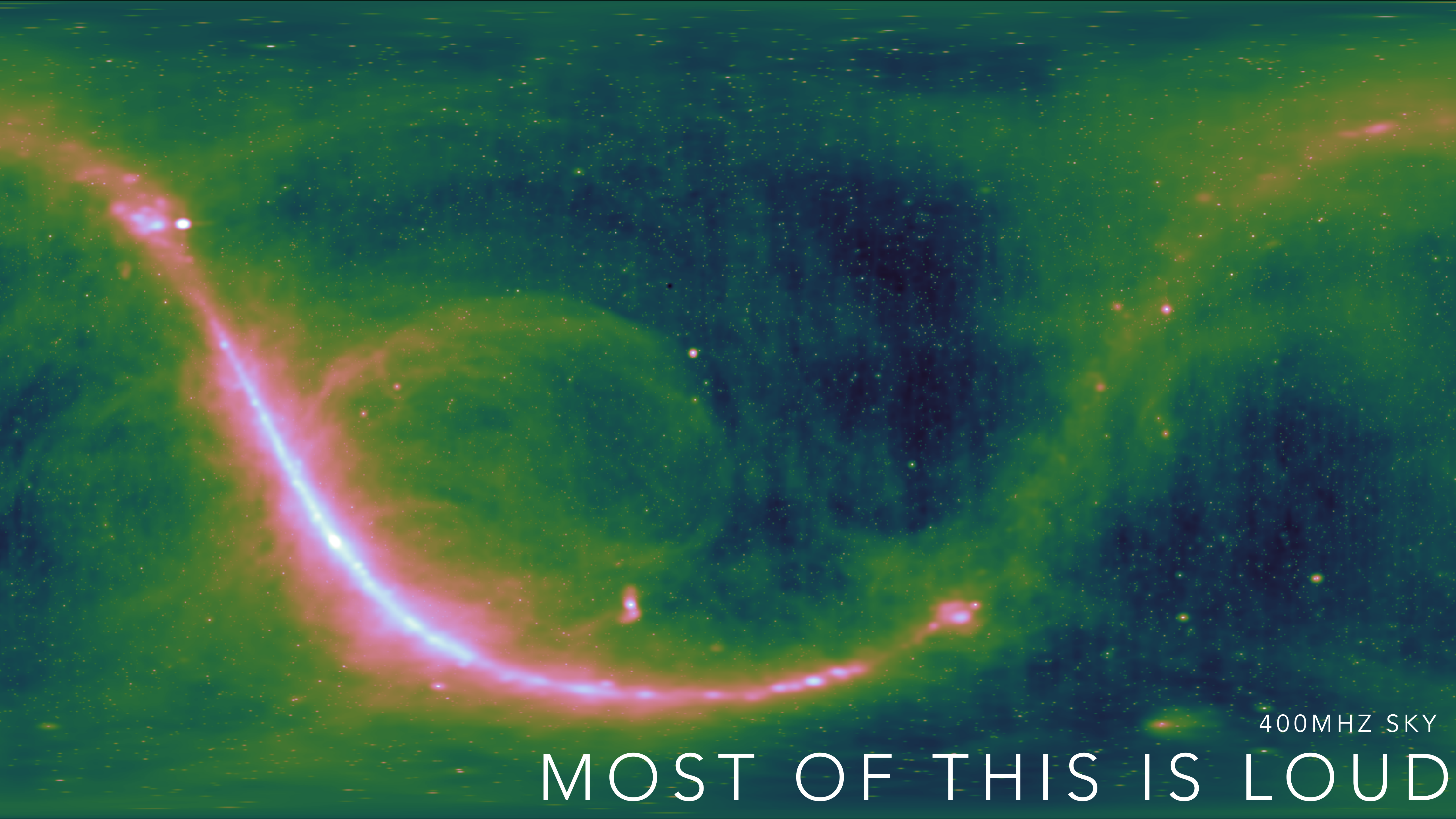


Looks like a star, sort of

TO THE SPECTRUM



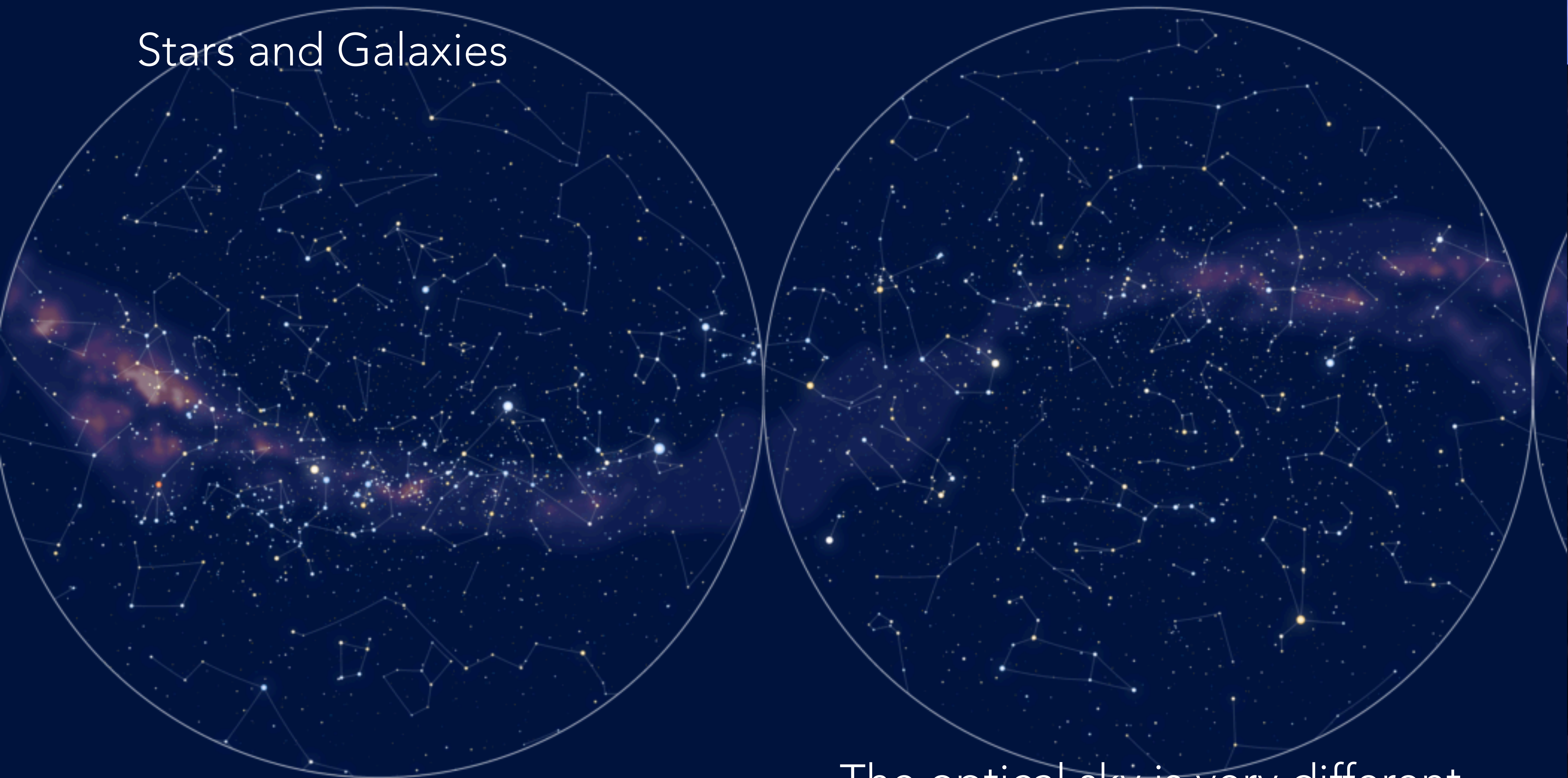




400MHZ SKY

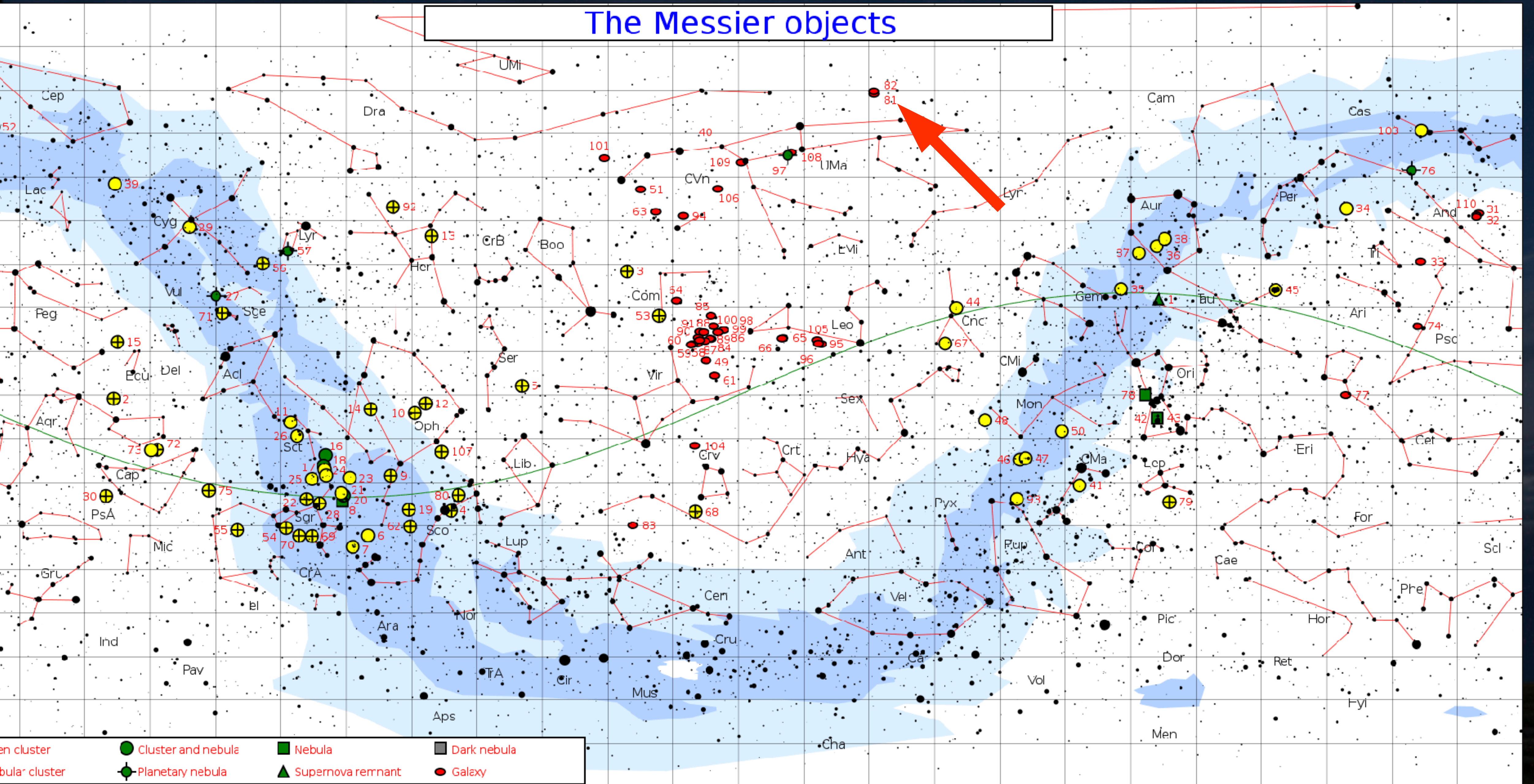
MOST OF THIS IS LOUD

Stars and Galaxies



The optical sky is very different

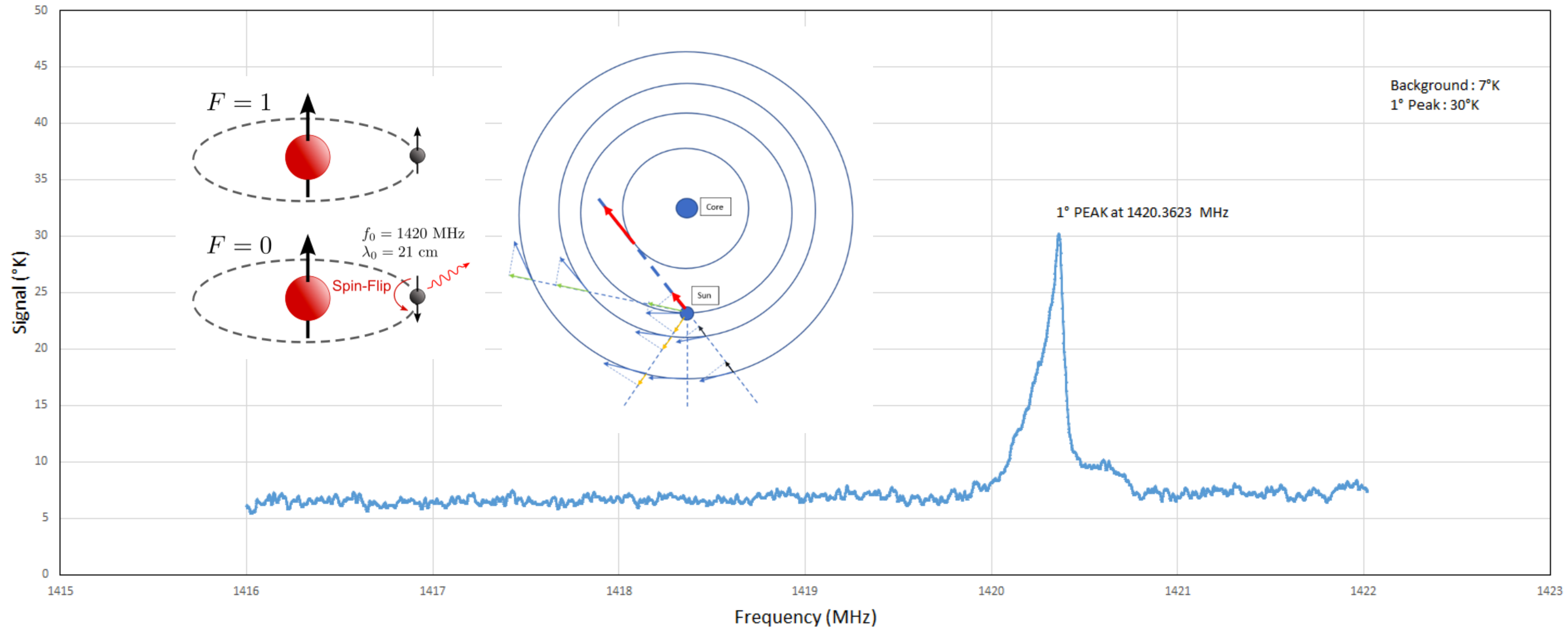
The Messier objects



M81 in Optical



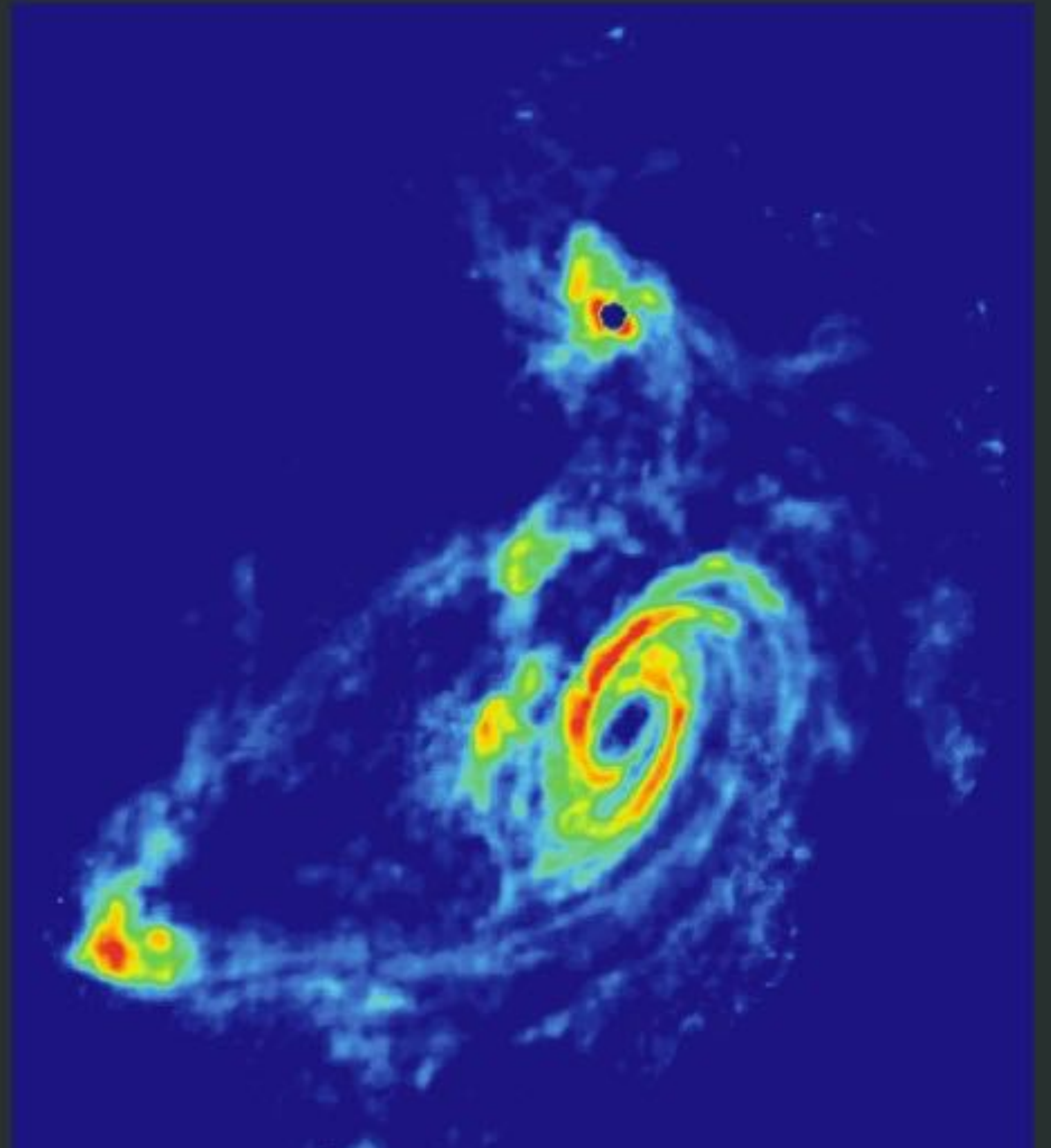
Power Spectrum - GLoang +43° GLat 0°



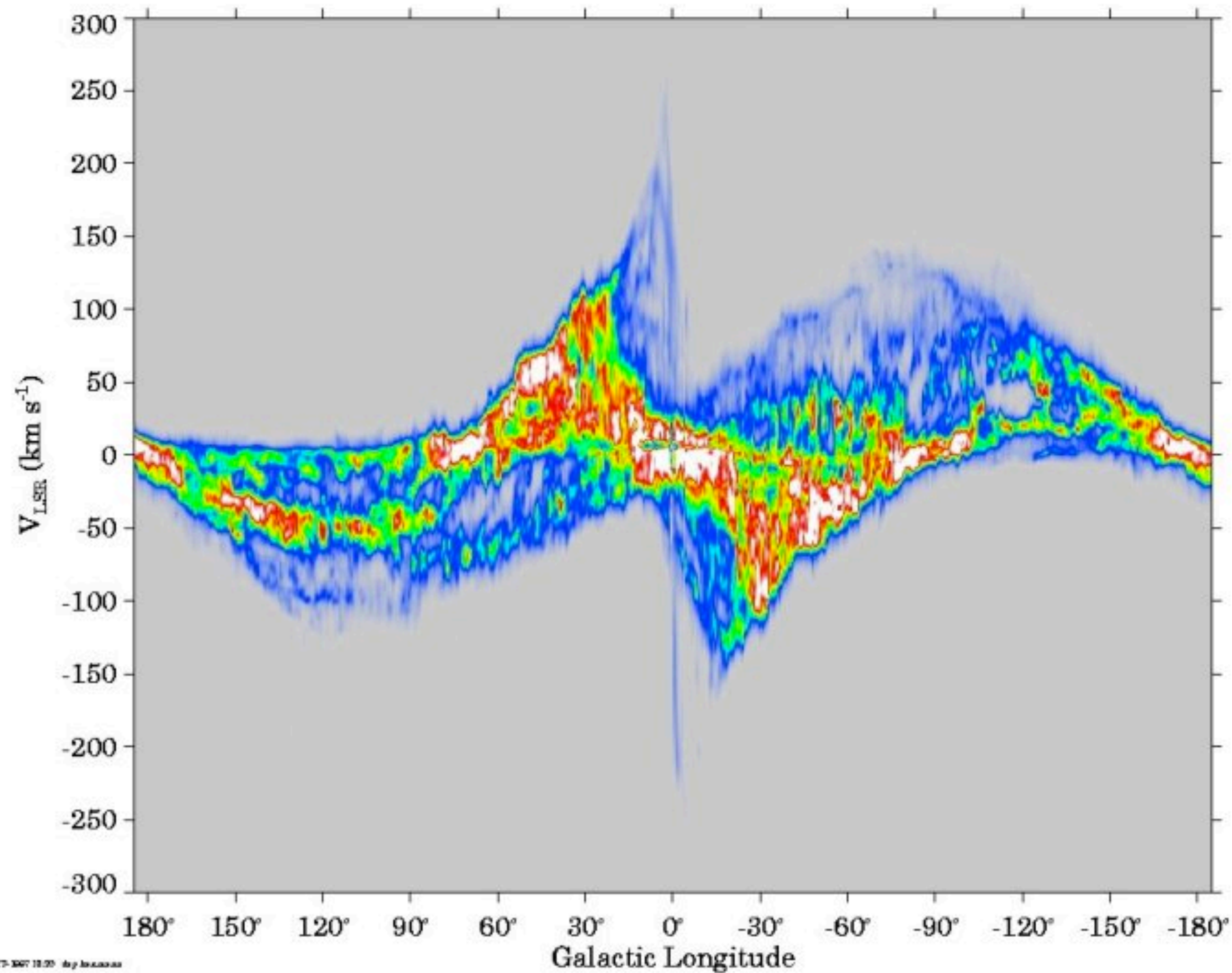
M81 in Optical

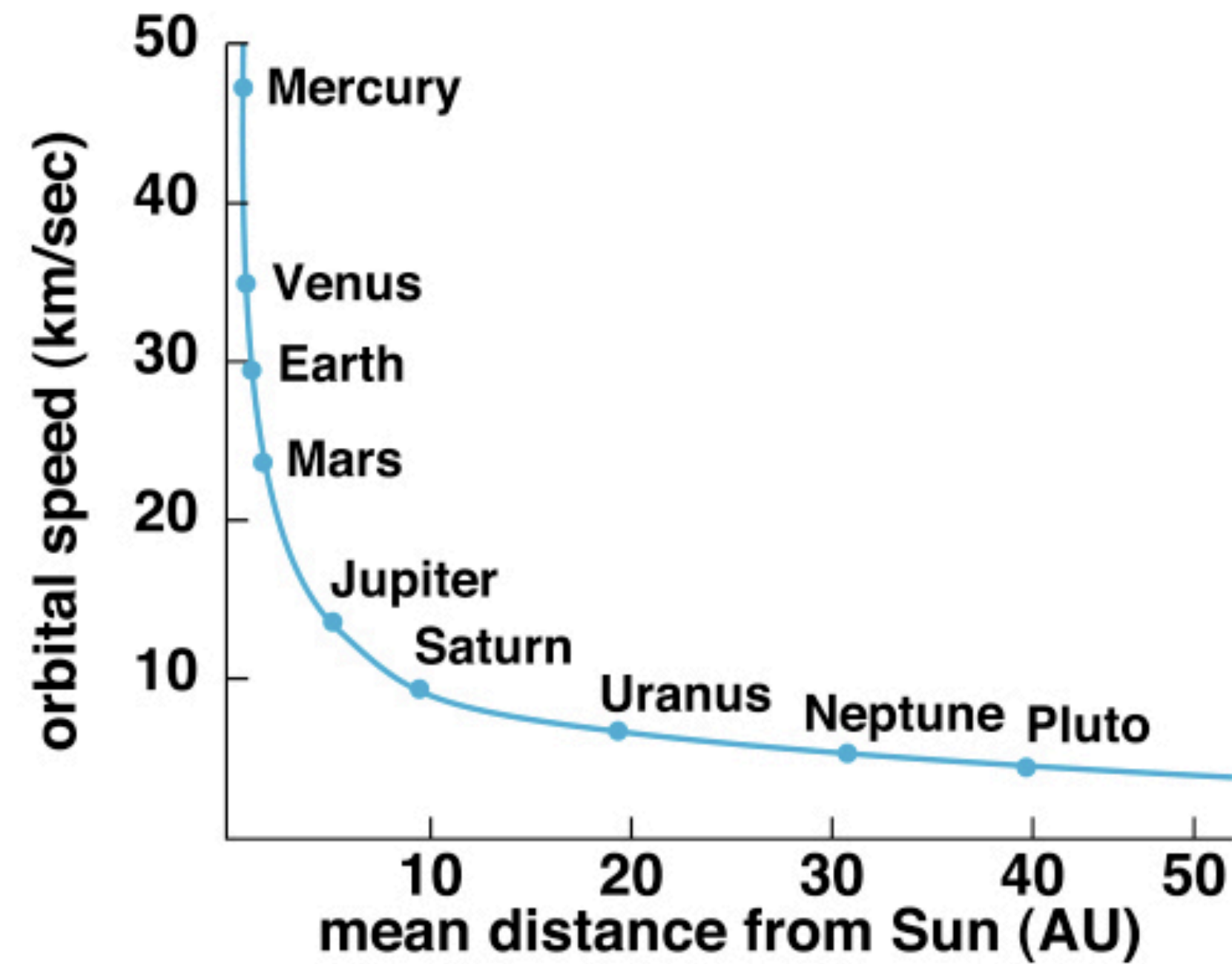


M81 in HI - 21cm

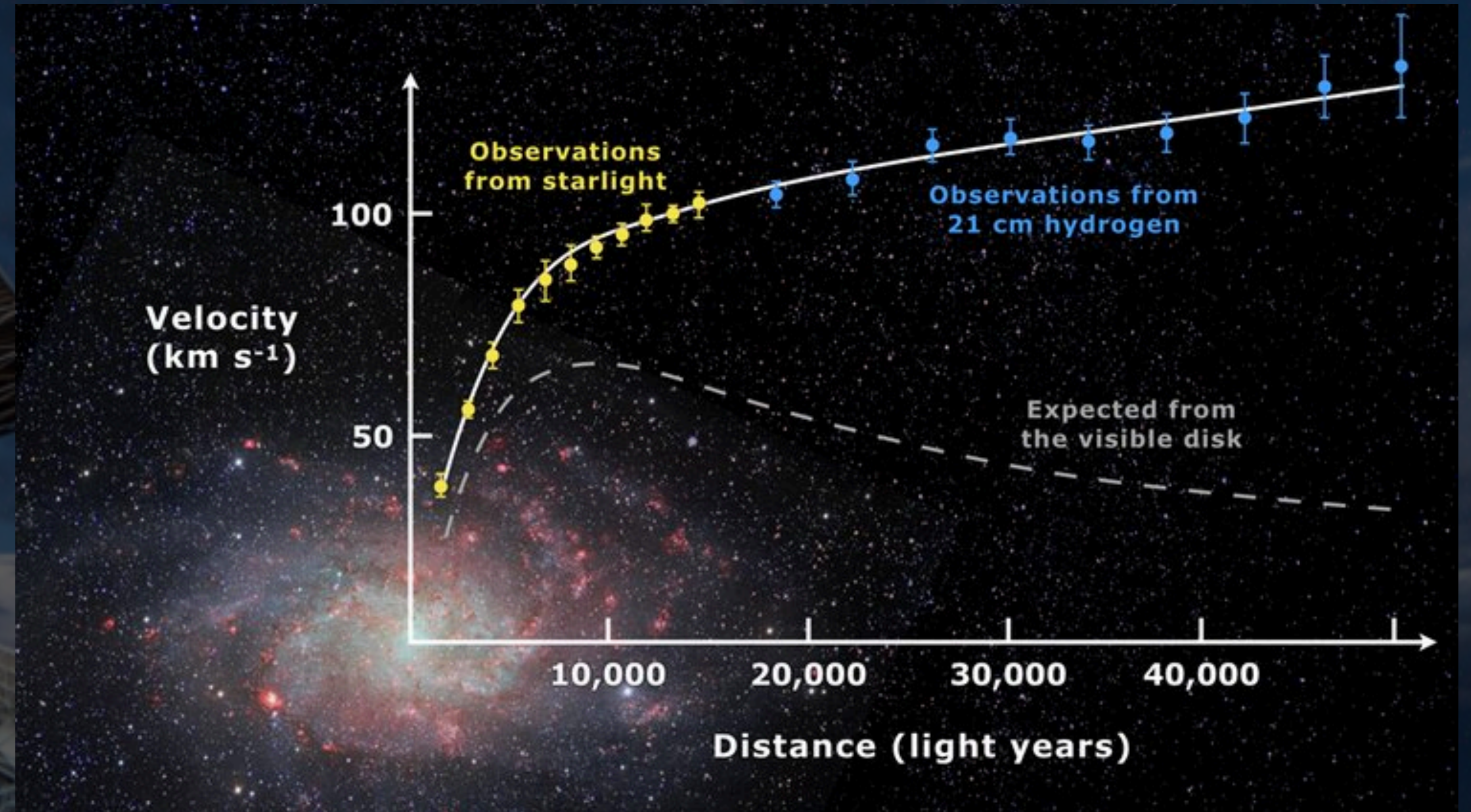


Leiden/Dwingeloo & IAR HI Surveys; $b = 0$





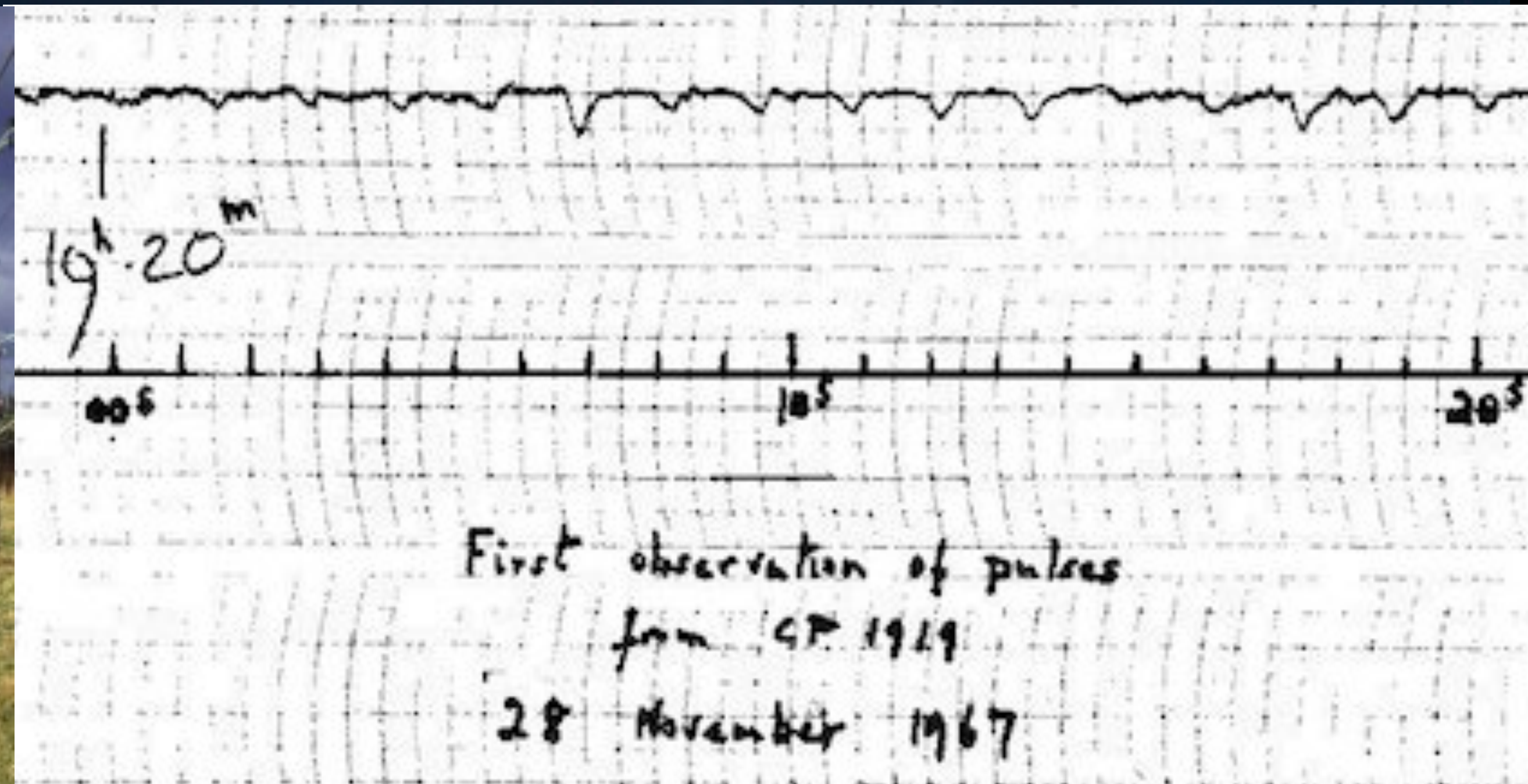
(b)
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PULSARS



Cambridge/ Mullard RAO Interplanetary Scintillation Array
ca 1968



Observation of a Rapidly Pulsating Radio Source

by

A. HEWISH
S. J. BELL
J. D. H. PILKINGTON
P. F. SCOTT
R. A. COLLINS

Mullard Radio Astronomy Observatory,
Cavendish Laboratory,
University of Cambridge

Unusual signals from pulsating radio sources have been recorded at the Mullard Radio Astronomy Observatory. The radiation seems to come from local objects within the galaxy, and may be associated with oscillations of white dwarf or neutron stars.

In July 1967, a large radio telescope operating at a frequency of 81.5 MHz was brought into use at the Mullard Radio Astronomy Observatory. This instrument was

of three others having remarkably similar properties which suggests that this type of source may be relatively common at a low flux density. A tentative explanation



The IPS array today.

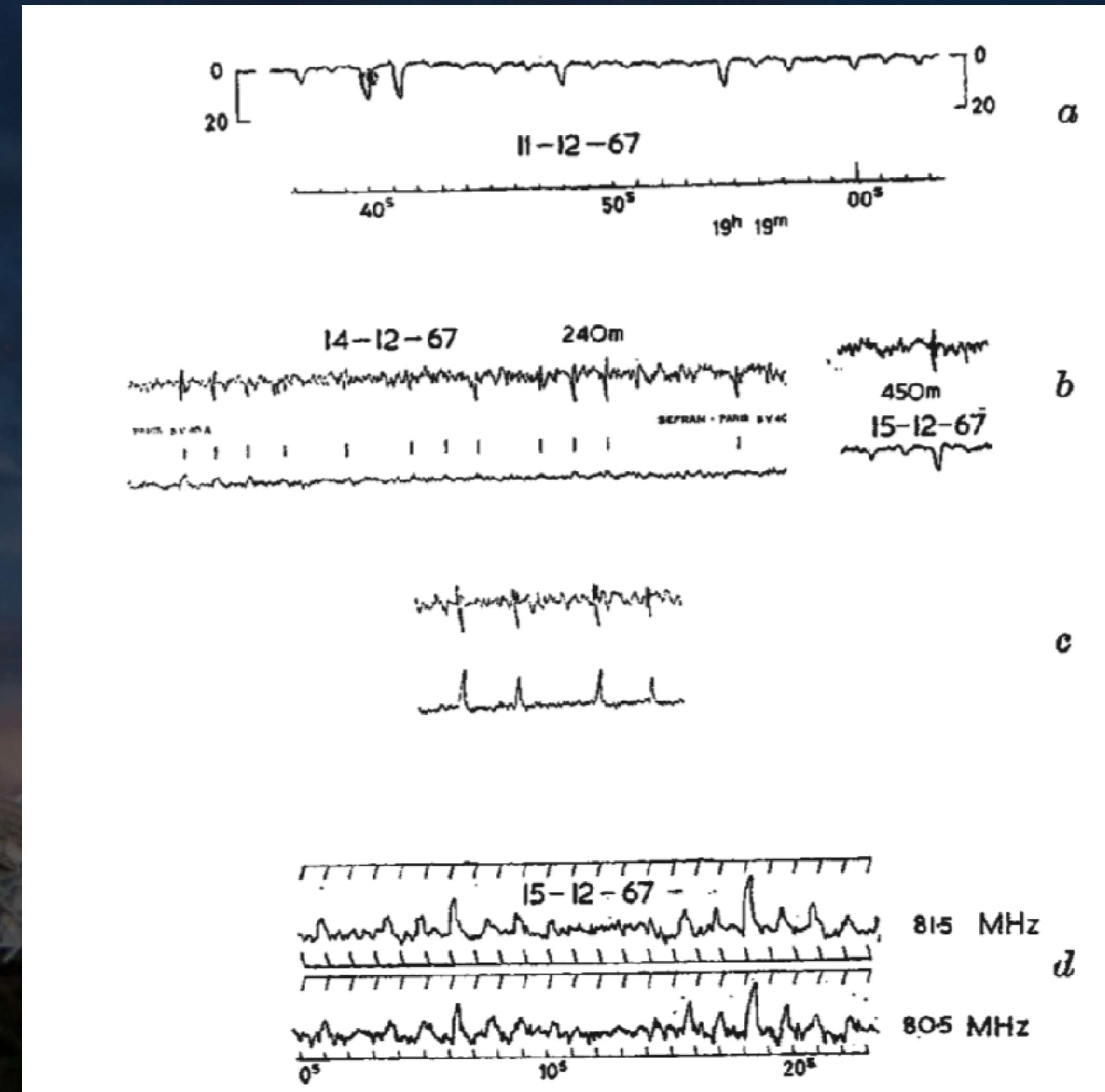
Copper thieves have had their way with it.



Pulsars are ubiquitous.

DISCOVERY

- Object name: PSR1919+21
- Pulses are extremely regular
- Pulses are delayed at lower frequencies



Hewish, Burnell, et al 1967

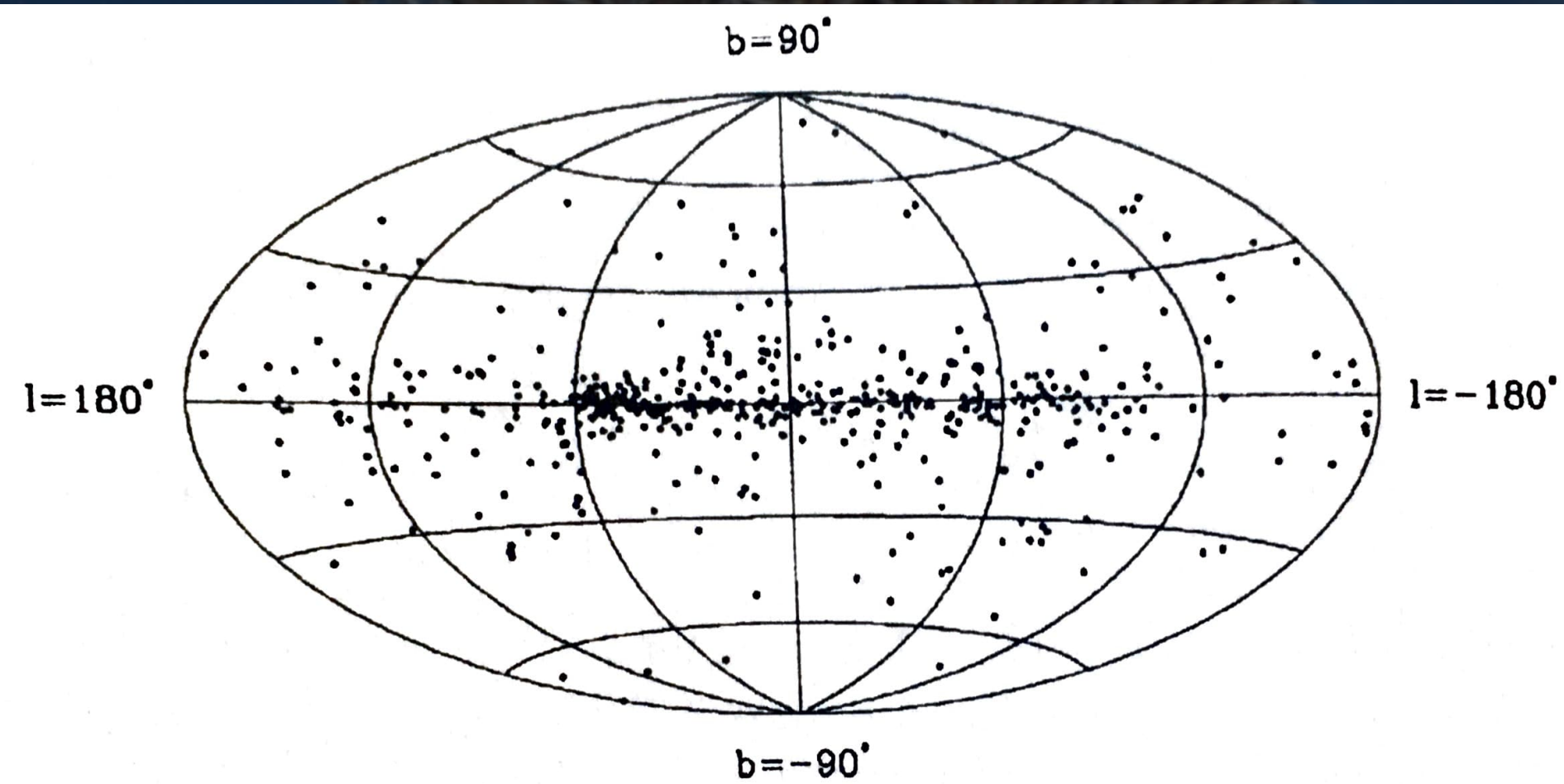


Fig. 11.9 Distribution of 558 pulsars in Galactic coordinates (from Taylor et al. 1993)

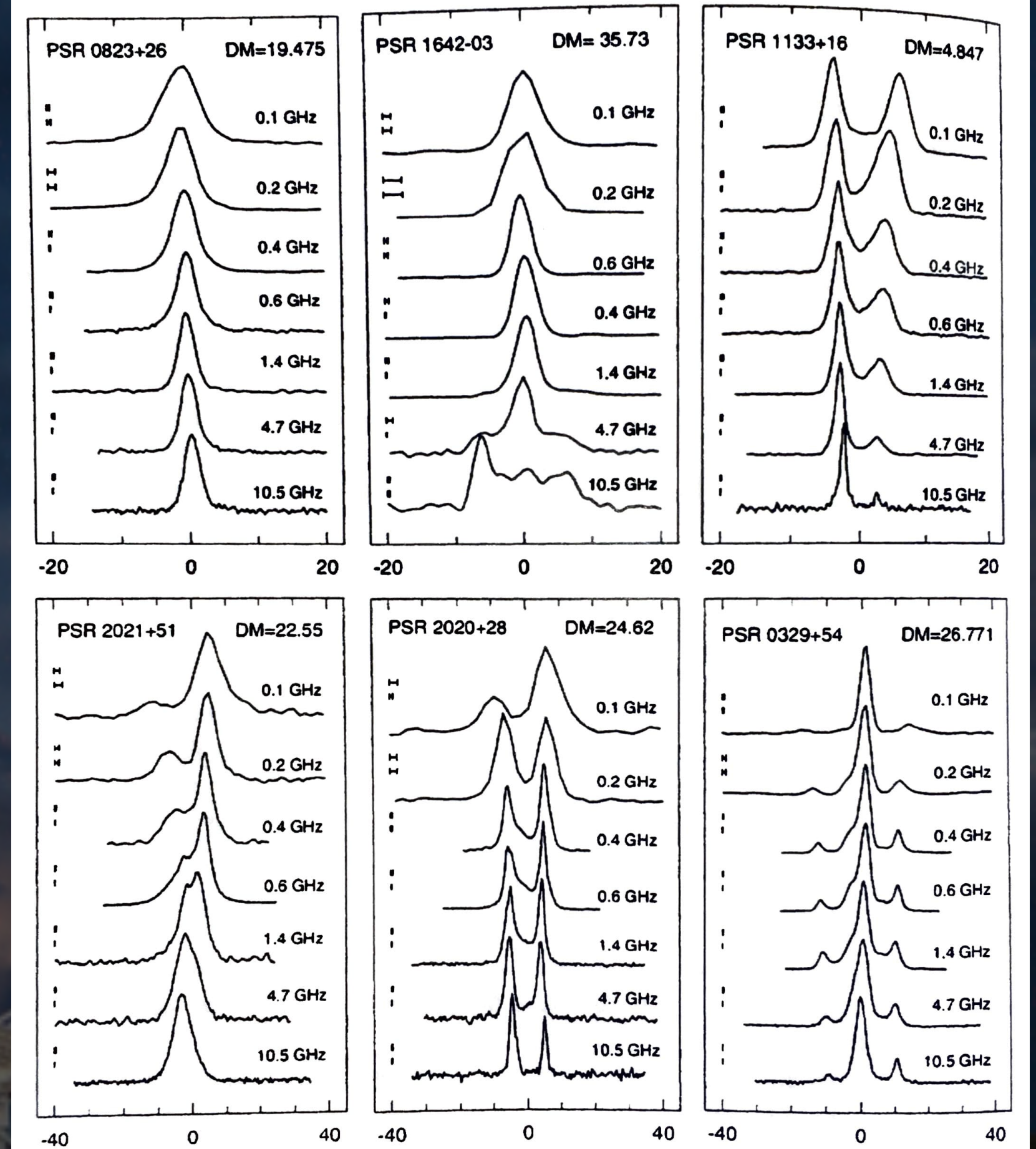
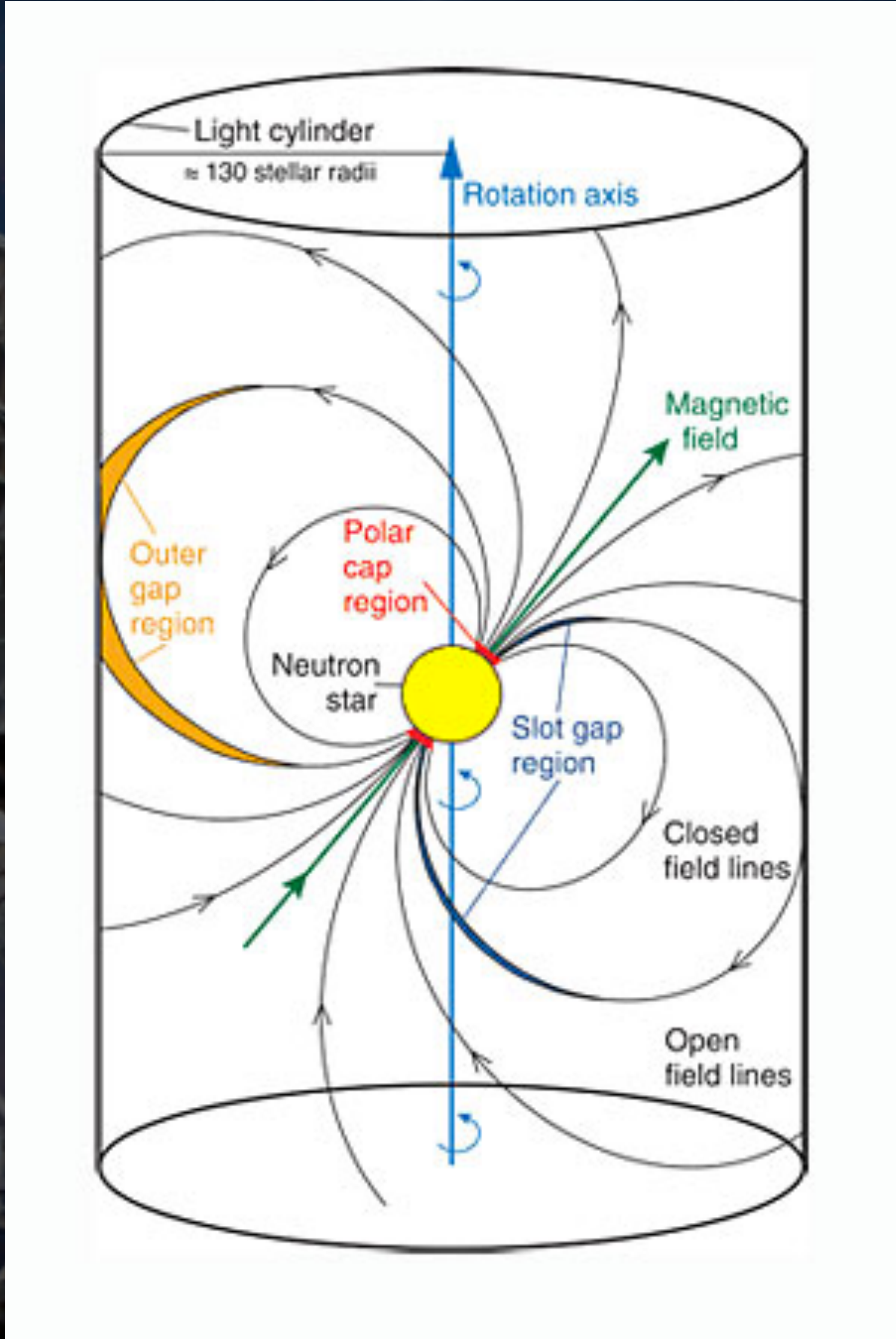
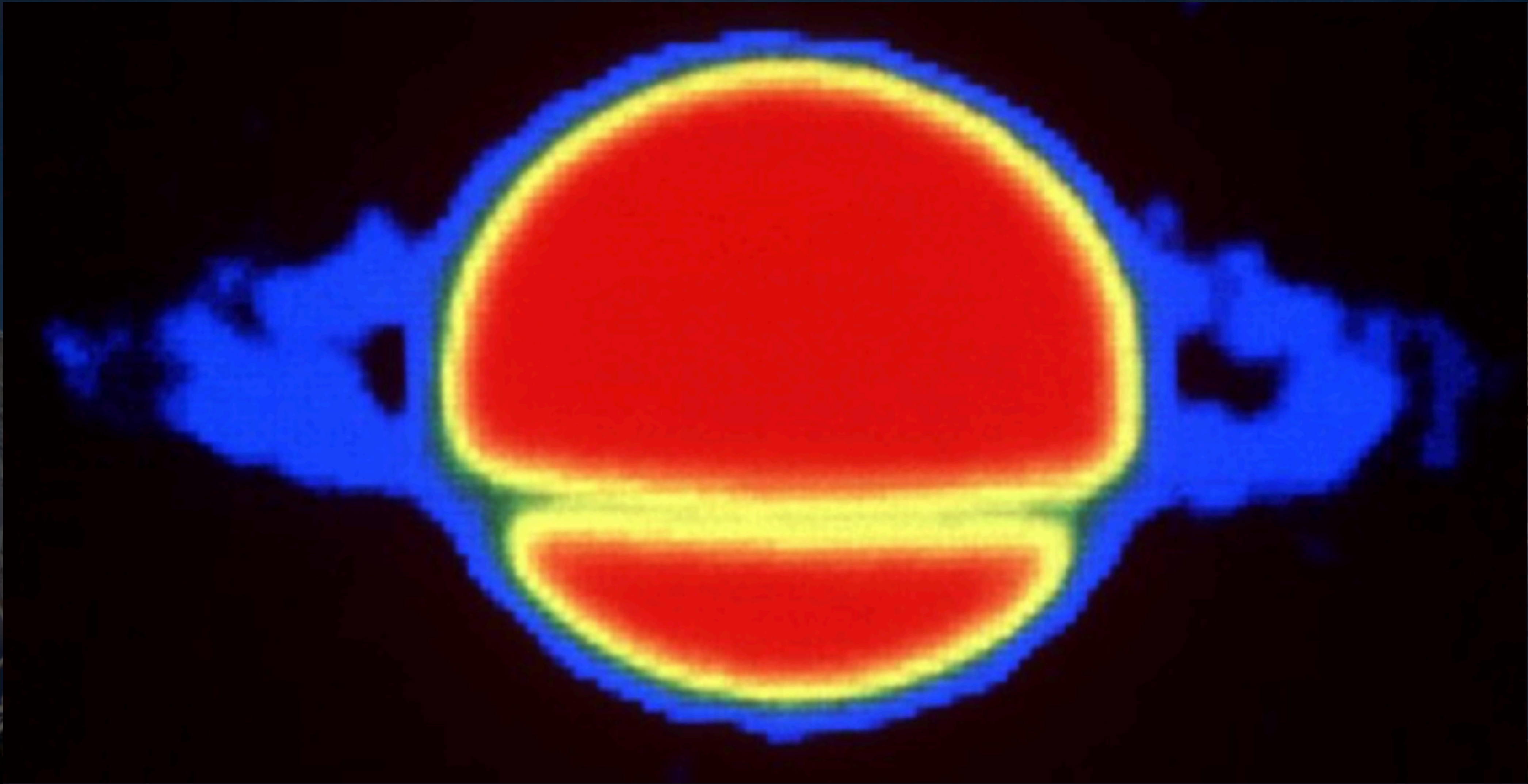
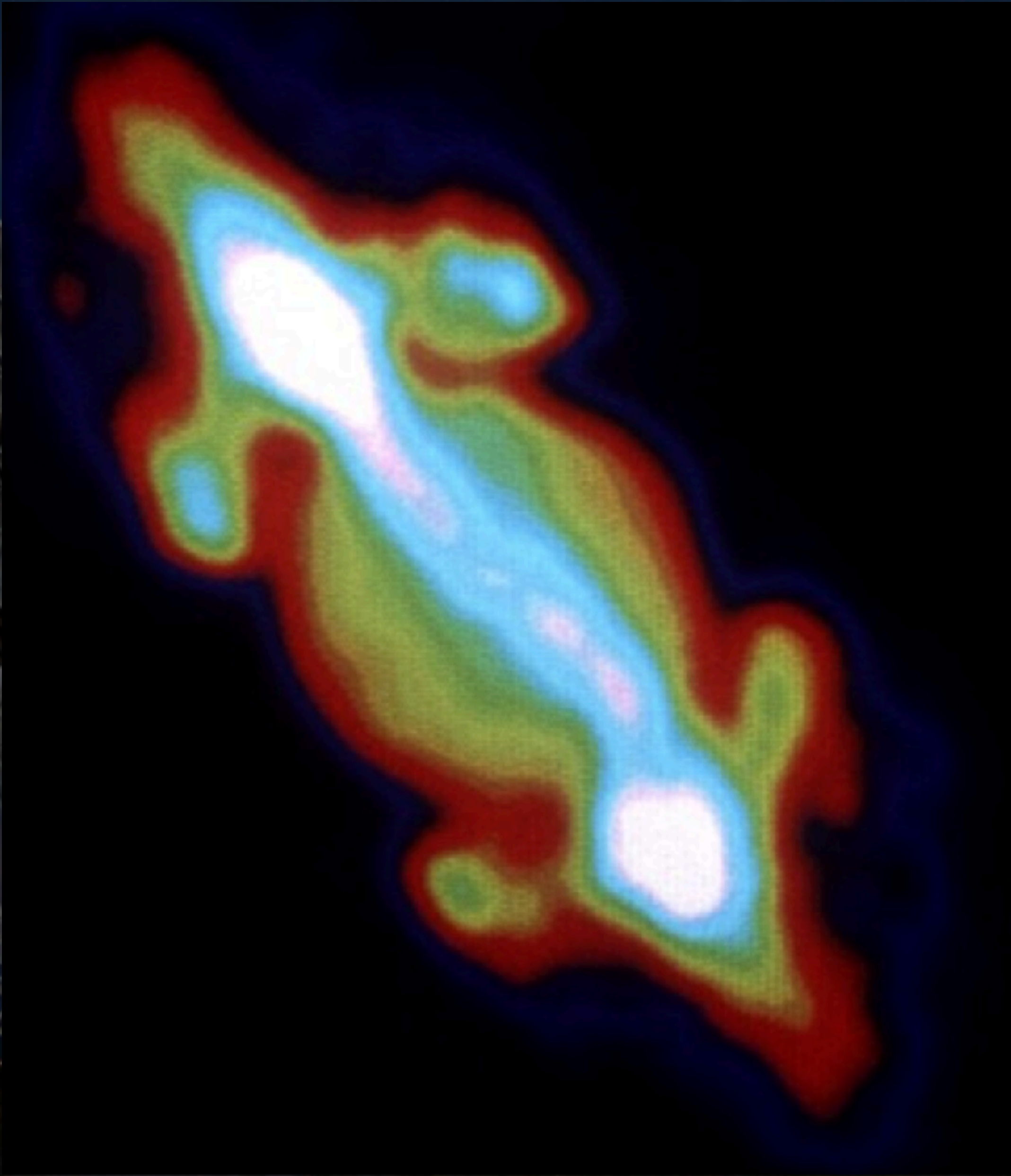
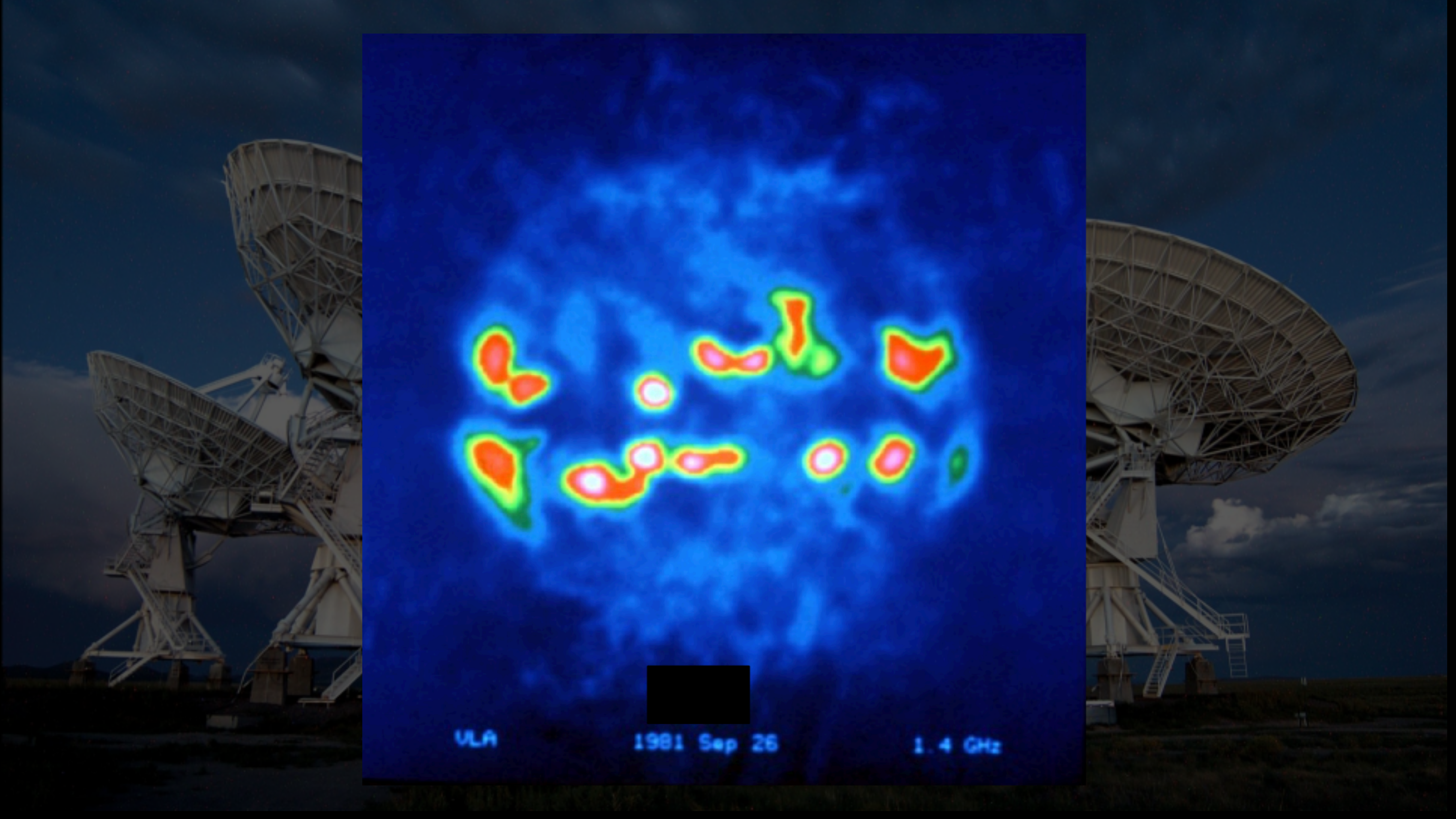


Fig. 11.10 Integrated pulse profiles plotted in the same rotation scale for each pulsar for frequencies 0.1–10.5 GHz. The pulse dispersion has been removed (figure from data in Kuzmin et al. 1998)





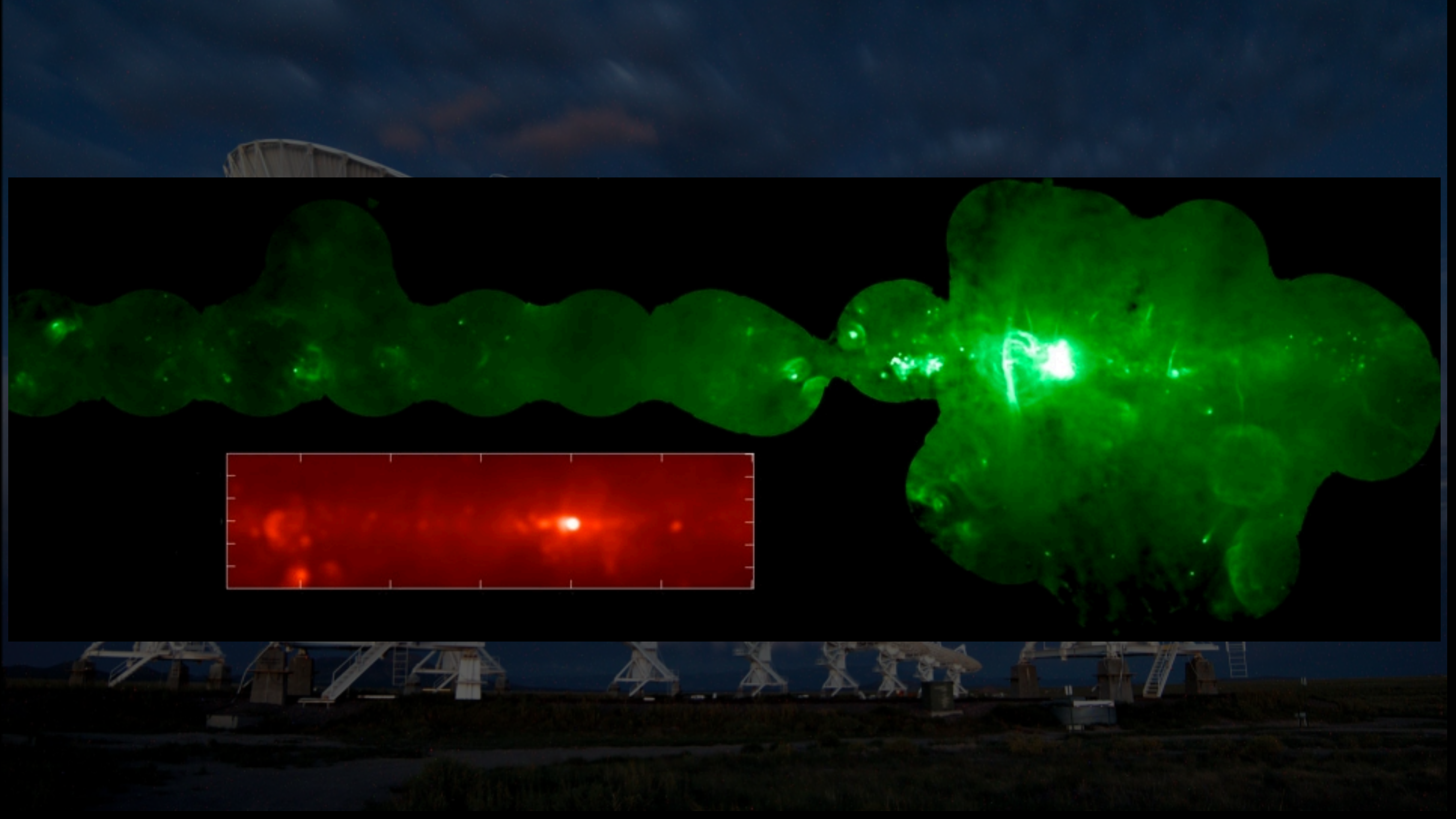




ULA

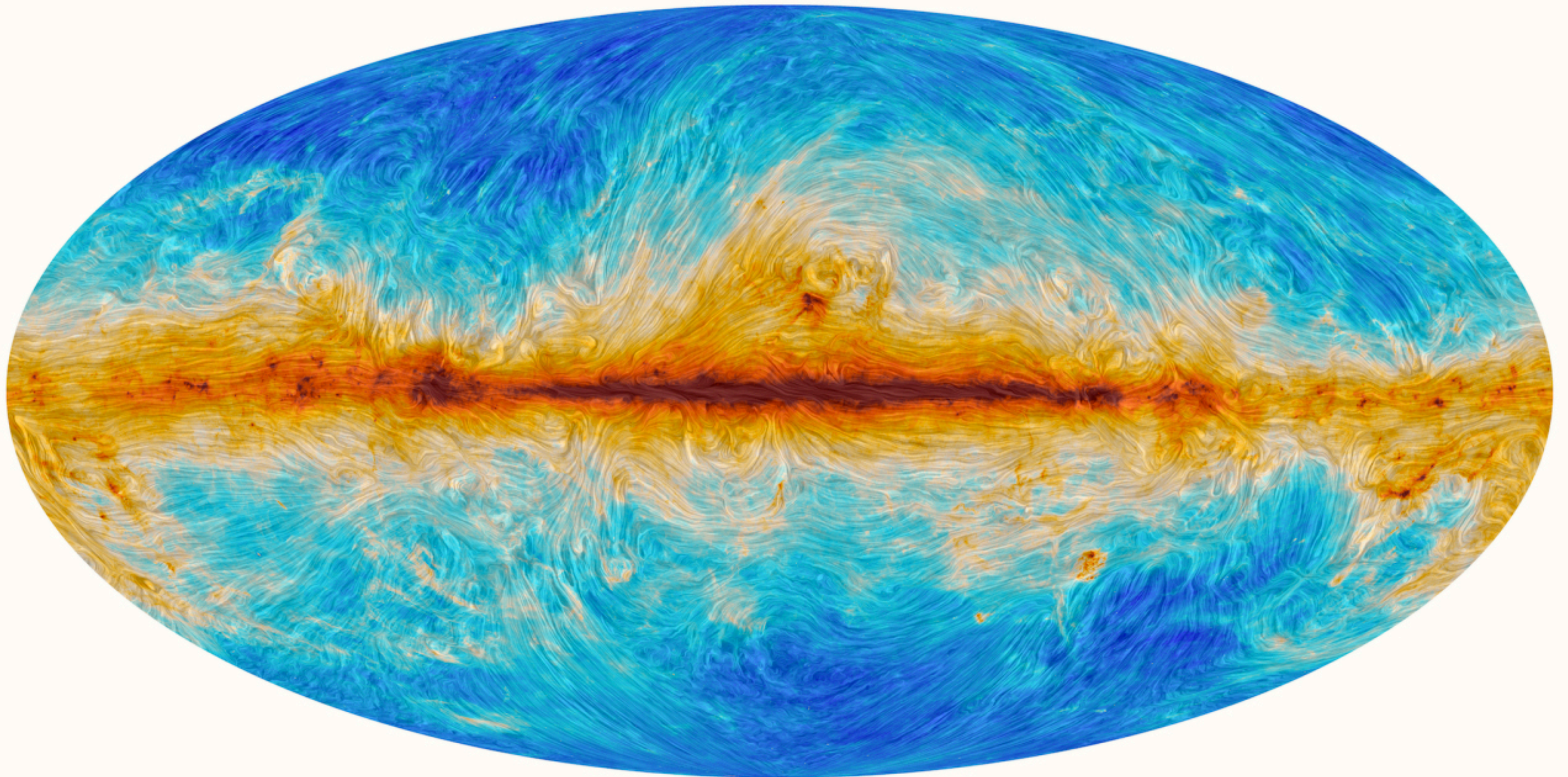
1981 Sep 26

1.4 GHz

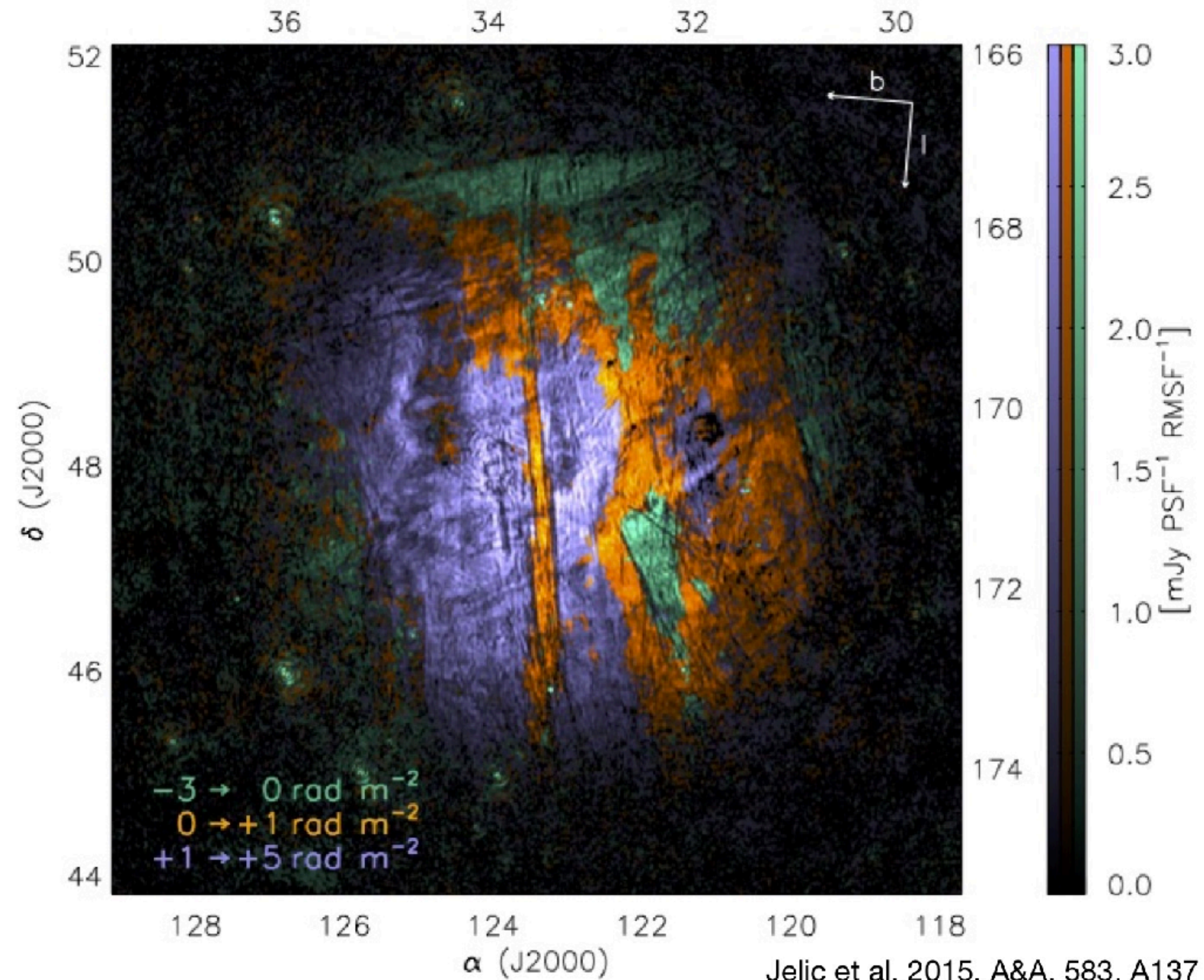




PLANCK MEASUREMENTS OF POLARIZATION



ROTATION SYNTHESIS



NEXT TIME

- Discussion: Why Radio is tricky (re ALMA ProxCen analysis)
- Brightness
- Emission mechanisms

HOMEWORK

- For next Monday, read and comment on.
- Anglada et al 2017
ui.adsabs.harvard.edu/abs/2017ApJ...850L...6A/
- Macgregor et al 2018
ui.adsabs.harvard.edu/abs/2018ApJ...855L...2M/

