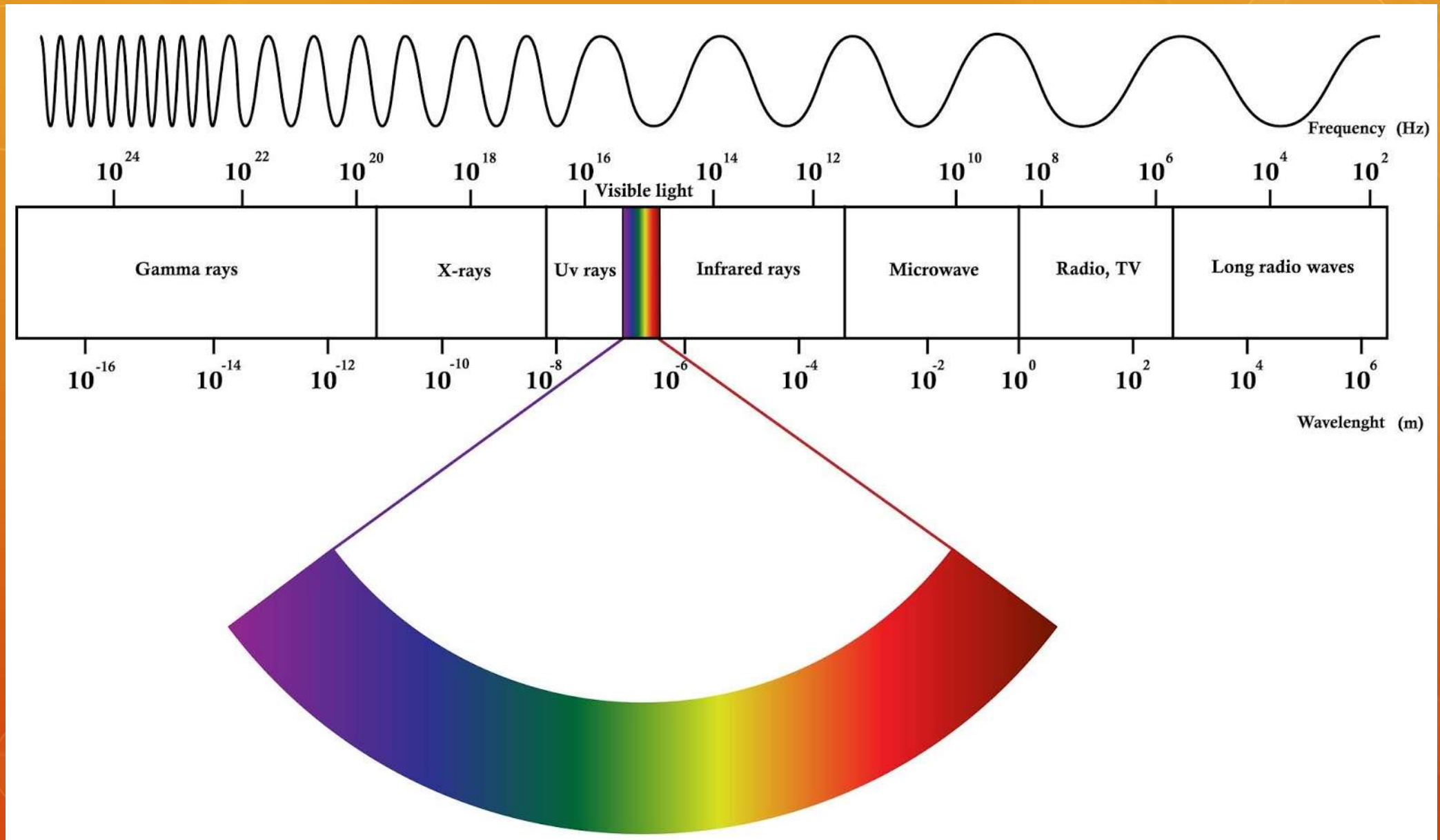
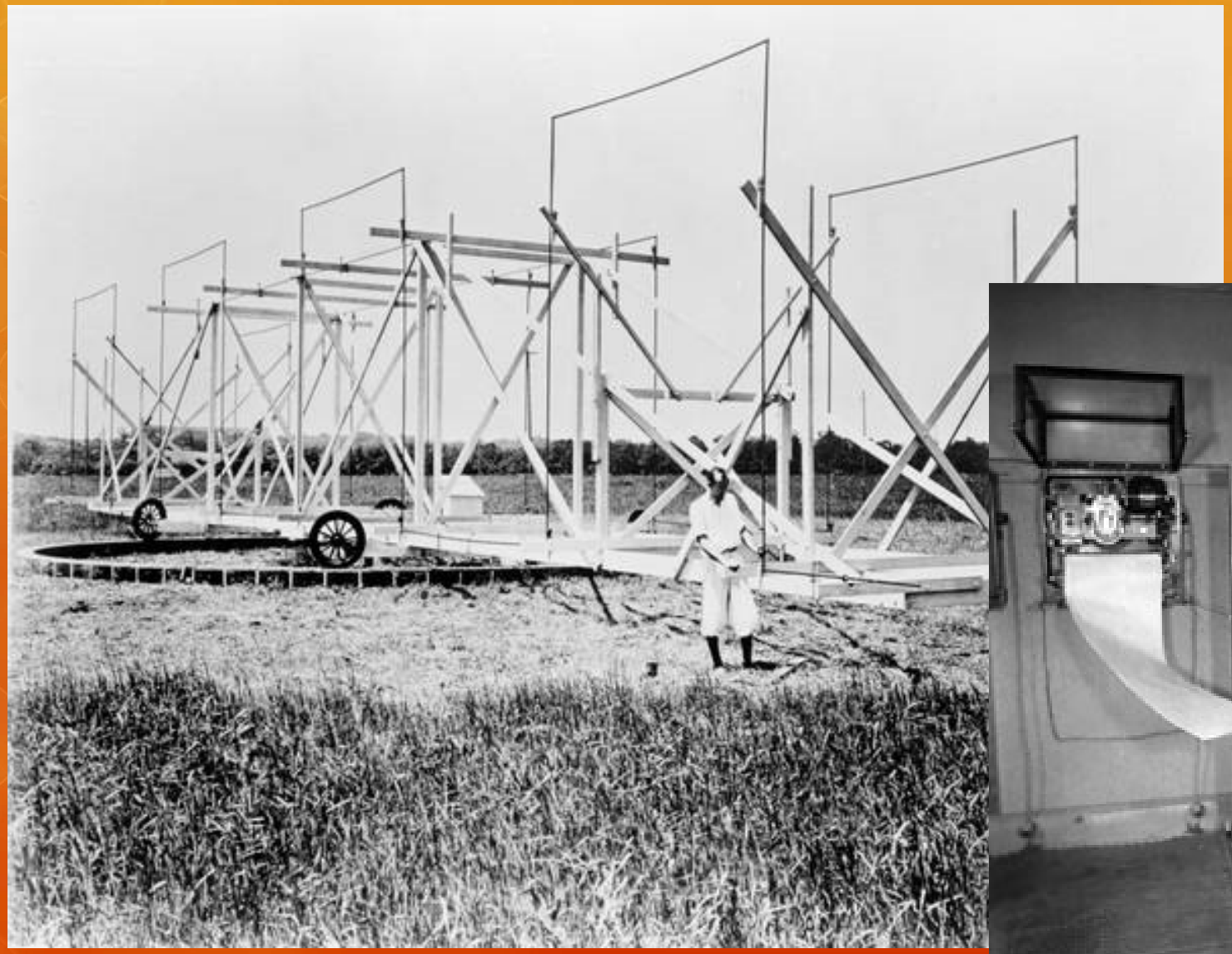
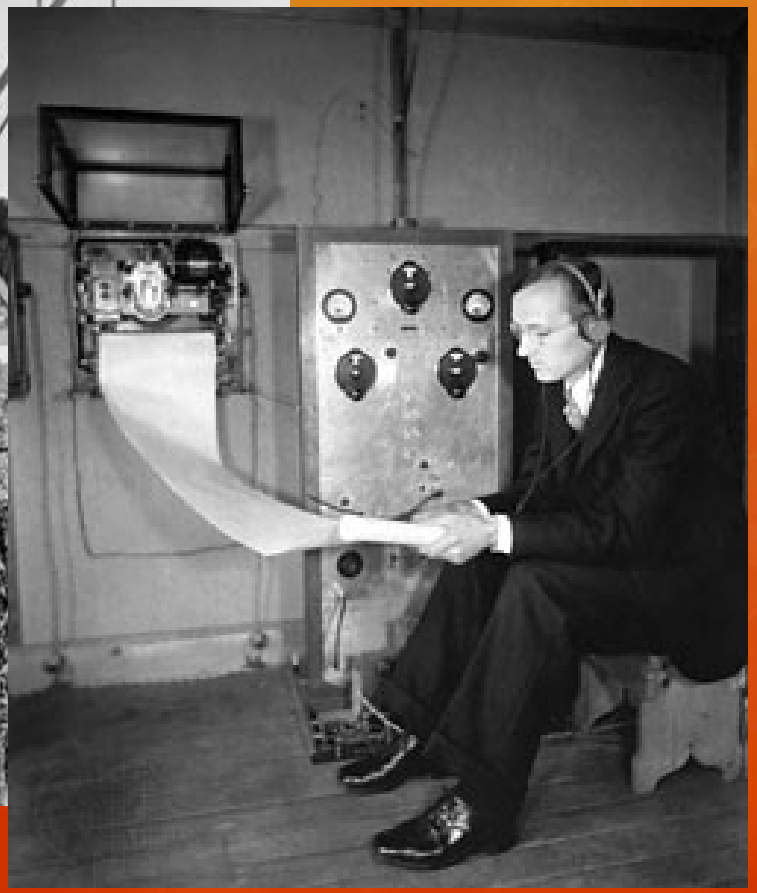
Introduction to Radio Astronomy and it's Effects on our Daily Living…

What does Radio Astronomy have over Optical?


Frequency (Hz)
10^24 10^22 10^20 10^18 10^16 10^14 10^12 10^10 10^8 10^6 10^4 10^2
Visible light
Gamma rays
X-rays
Uv rays
Infrared rays
Microwave
Radio, TV
Long radio waves
10^-16 10^-14 10^-12 10^-10 10^-8 10^-6 10^-4 10^-2 10^0 10^2 10^4 10^6
Wavelenght (m)

Father of Radio Astronomy





Grote Reber

First Radio Graph of our Galaxy

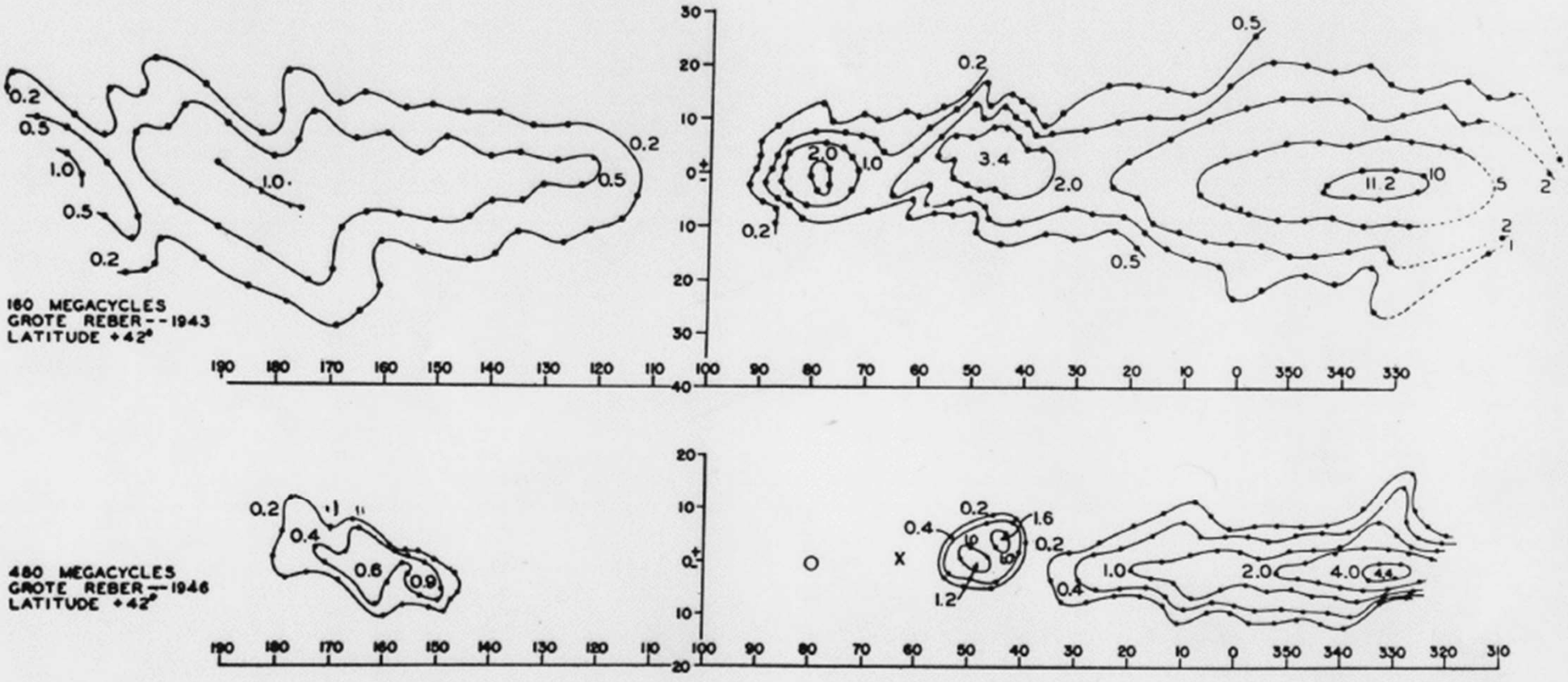
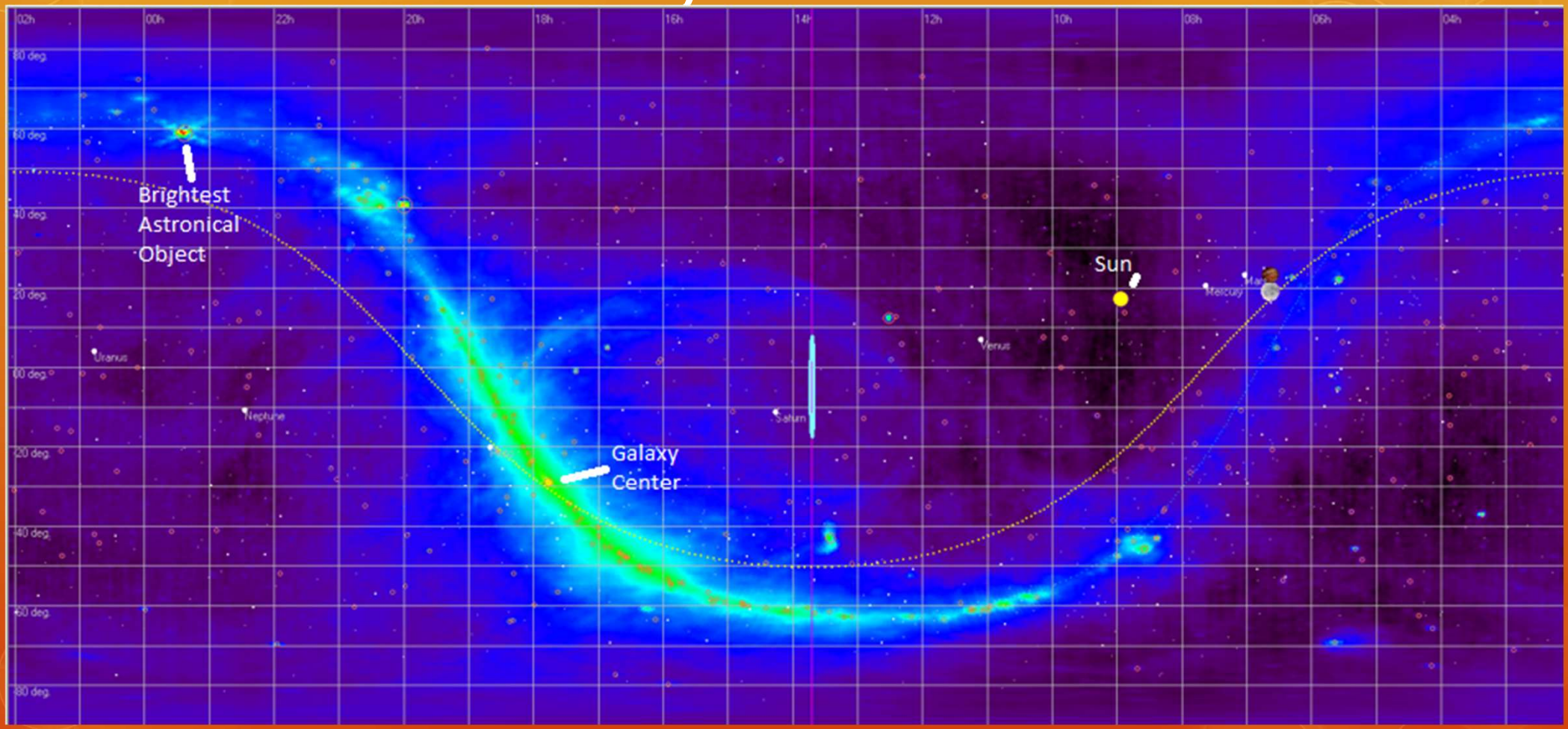


FIG. 7—Contours of constant intensity at 160 MHz and 480 MHz, taken at Wheaton, Illinois.

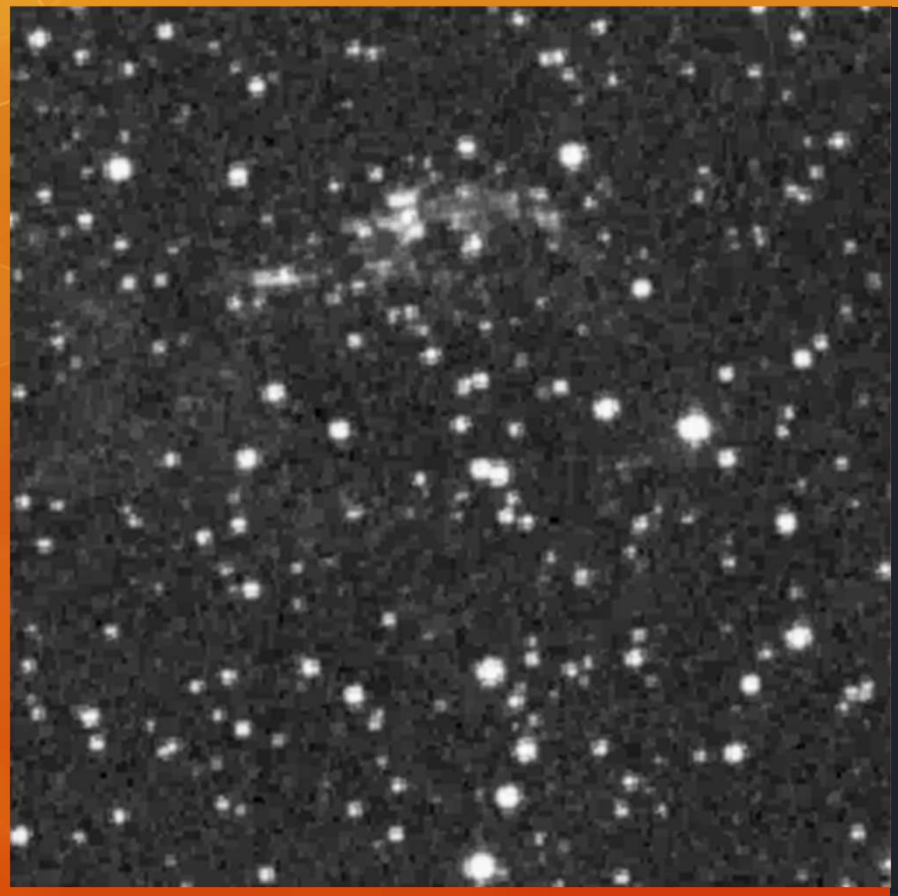
State of the art at the time in the 1930's…

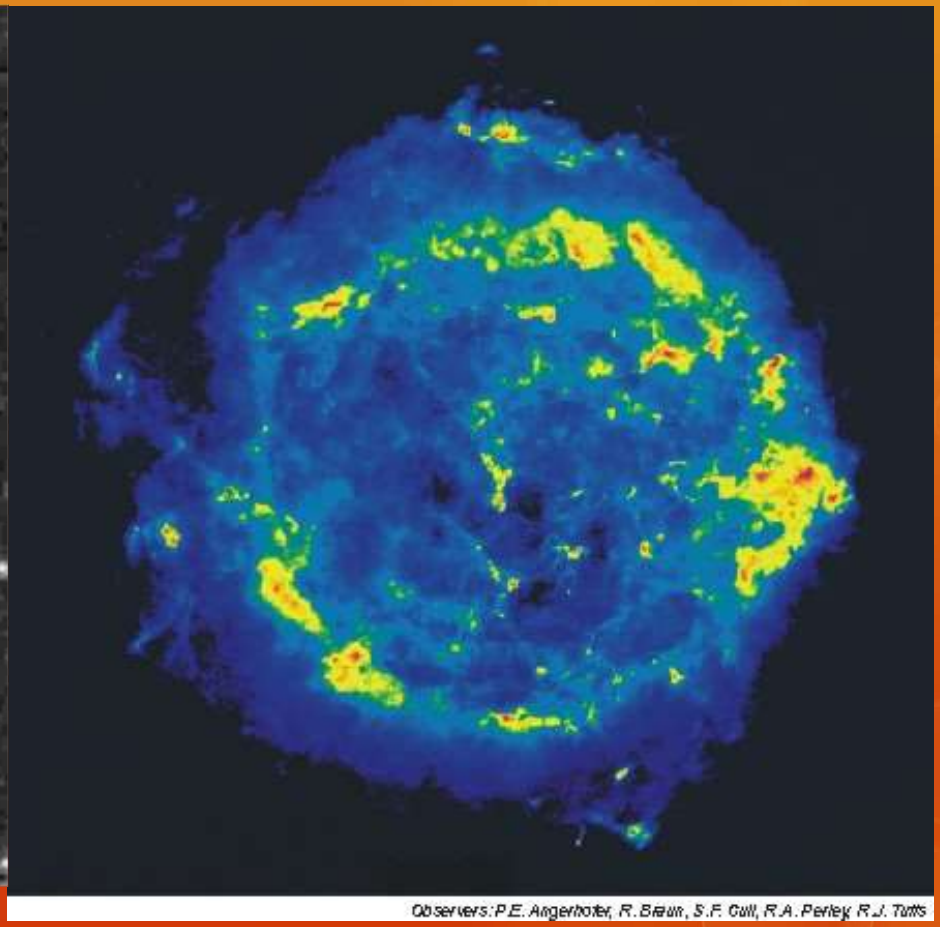
- Astronomers KNEW the universe was thermal.
- Radio was some new-fangled technology that was not going to see much due to the the low emission as predicted by the Stefan-Boltzmann equation.
- Radio telescopes have poor resolution. (Initial scopes had resolution measured in degrees)
- Most professional astronomers knew nothing about radio, so they assumed whatever was being received was probably just local noise.

The Whole Sky at 408 MHz.

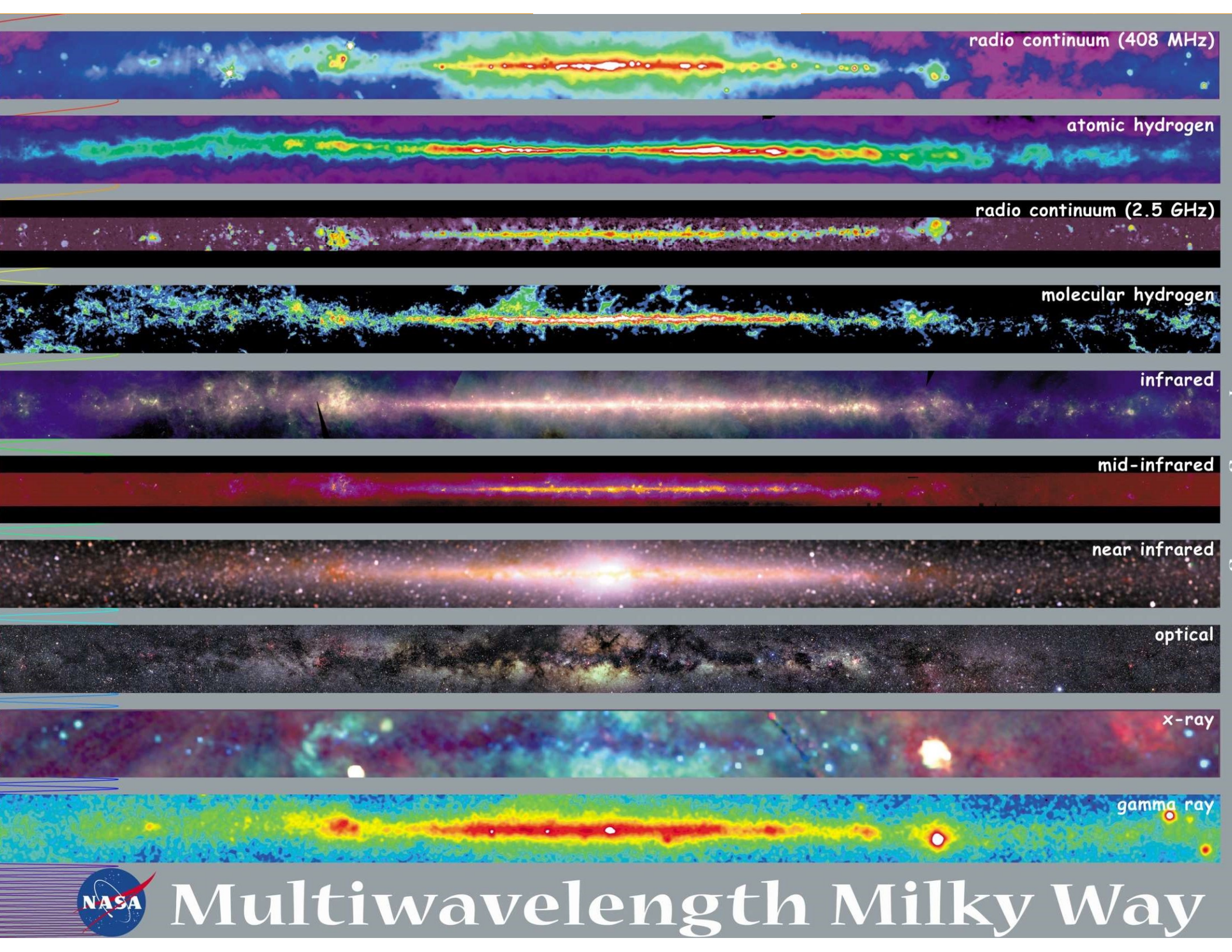


Supernova Remnant Cassiopeia A





Radio Galaxy Cygnus A

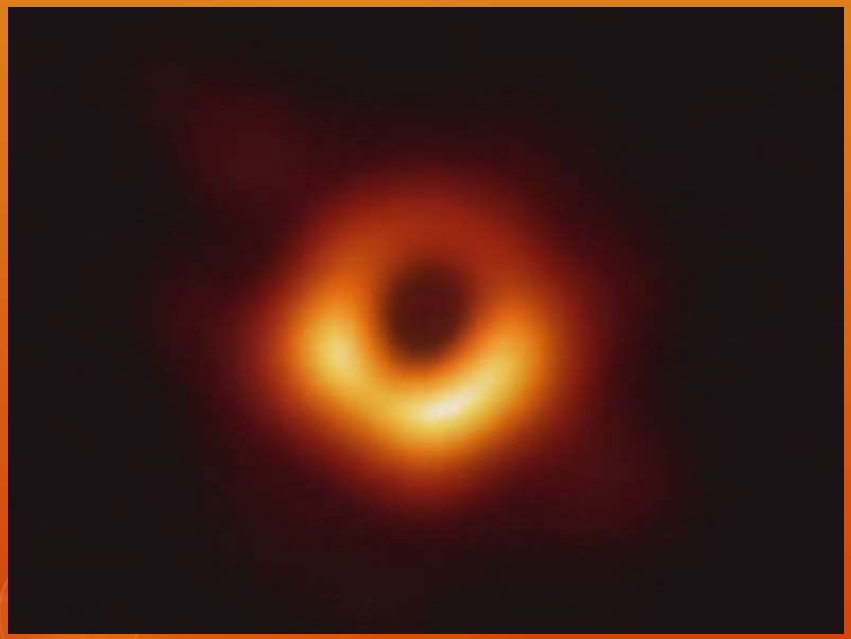

radio continuum (408 MHz)
atomic hydrogen
radio continuum (2.5 GHz)
molecular hydrogen
infrared
mid-infrared
near infrared
optical
x-ray
gamma ray
NASA
Multiwavelength Milky Way

What the professionals use

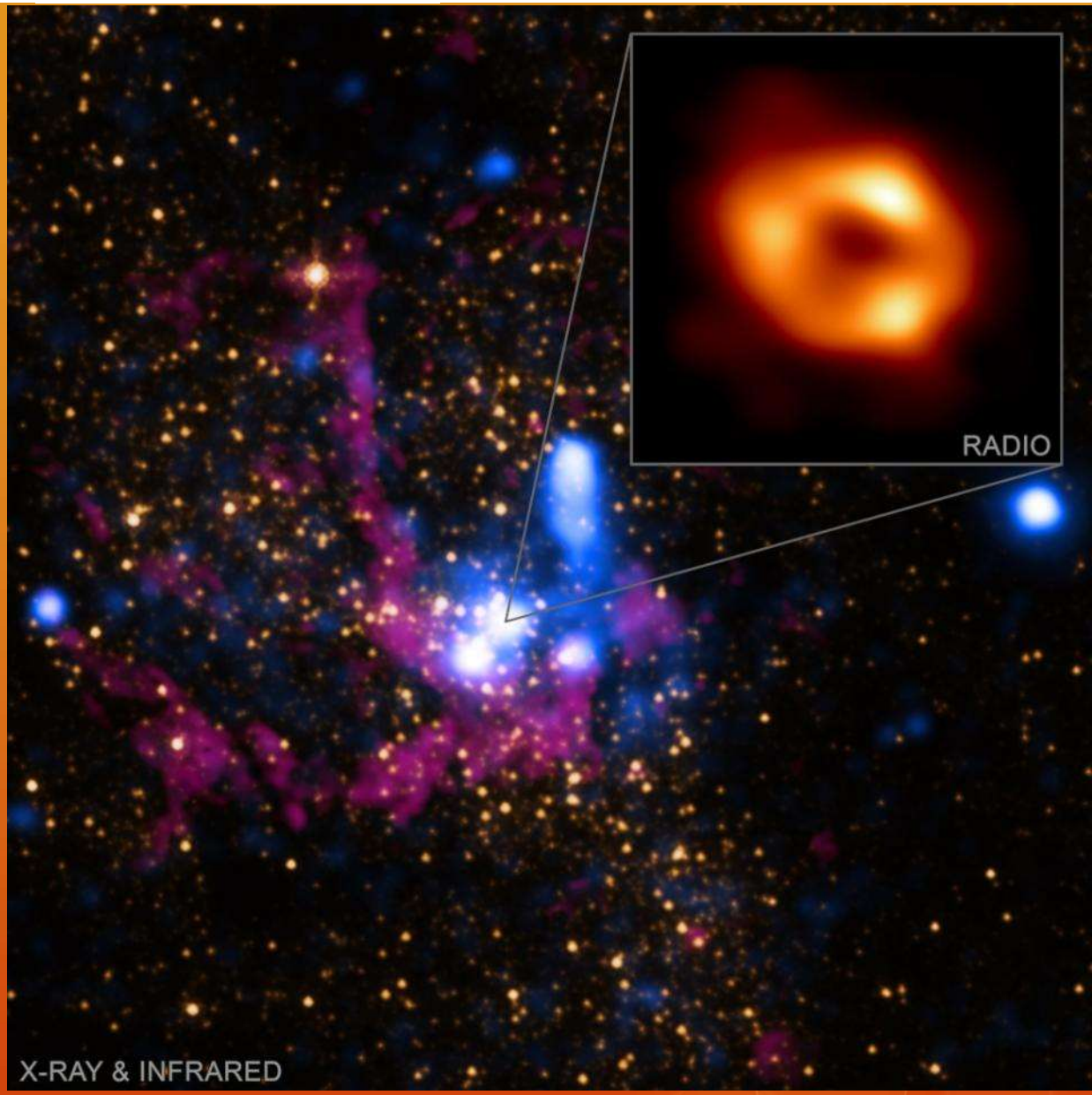

Image courtesy of NRAO/AU

VLA

Event Horizon Telescope



M82



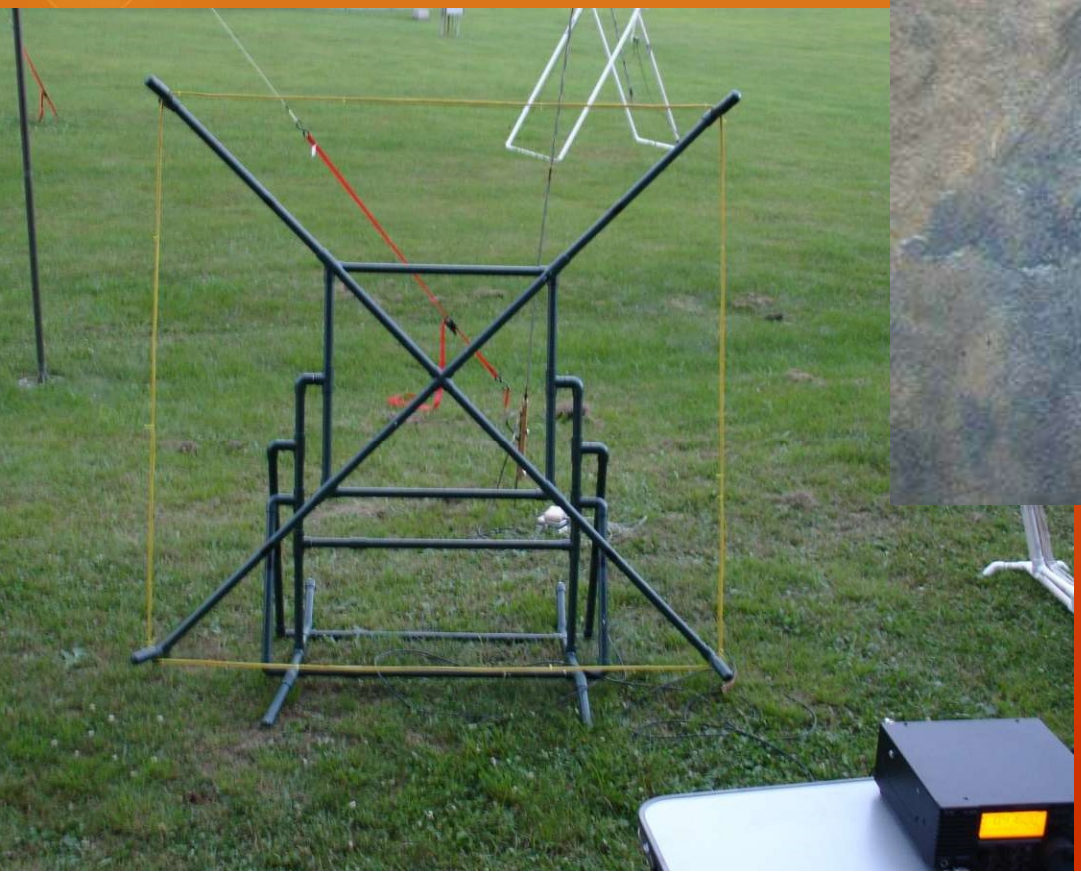
Sagittarius A*

What do the amateurs use?

Eyepieces…

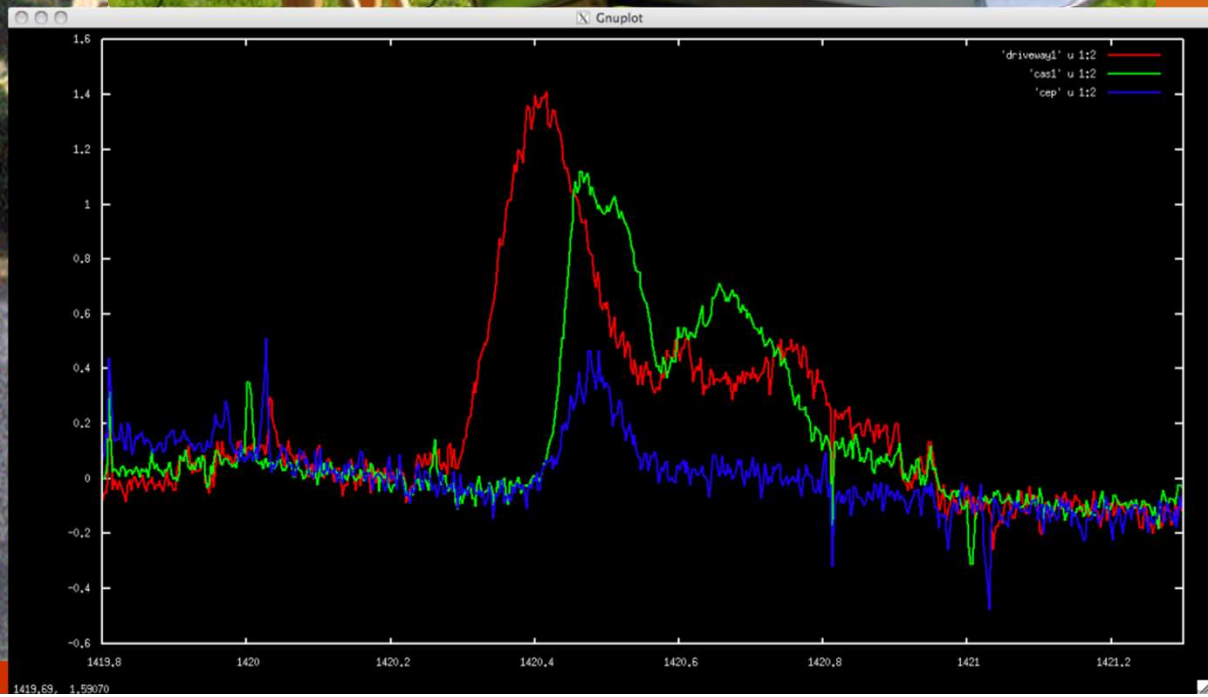
Radio Jove
http://radiojove.gsfc.nasa.gov/

SuperSID

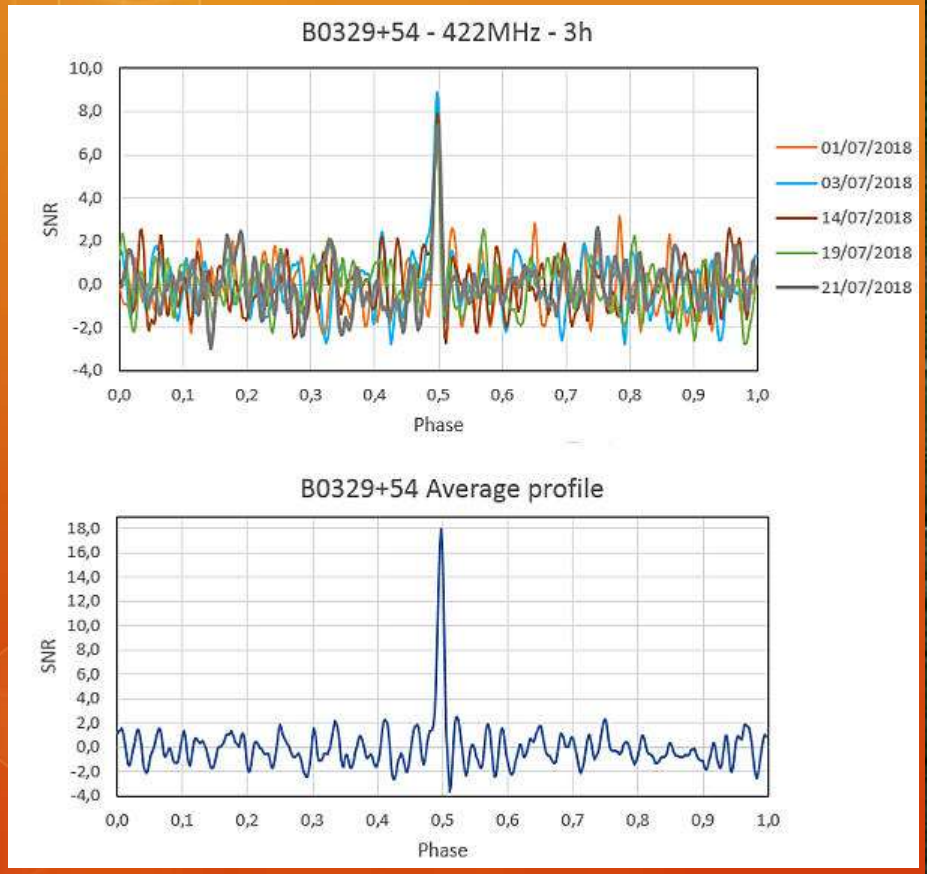


Hydrogen Line

http://wvurail.org



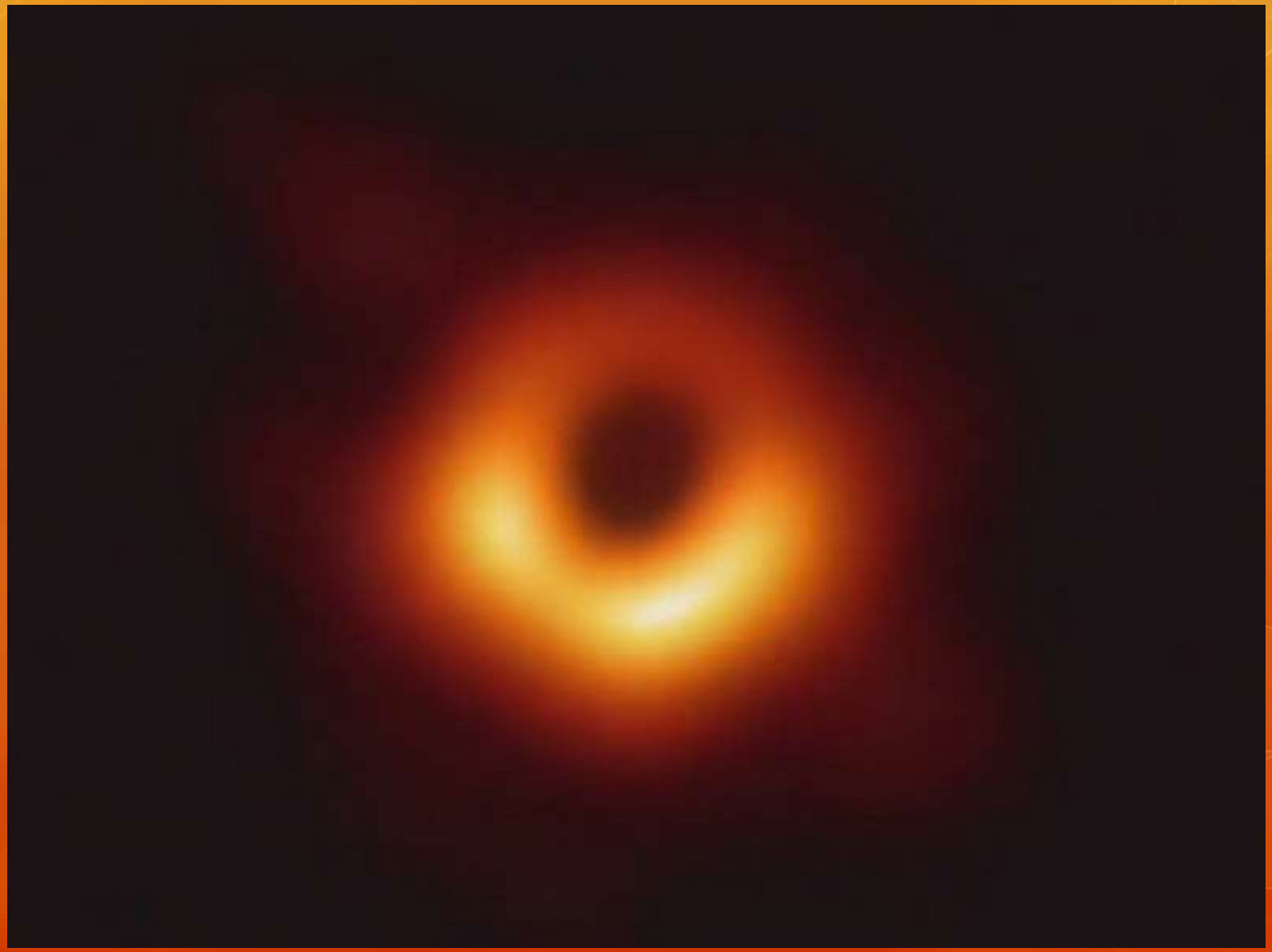
Pulsar detection is possible.



Bigger toys…

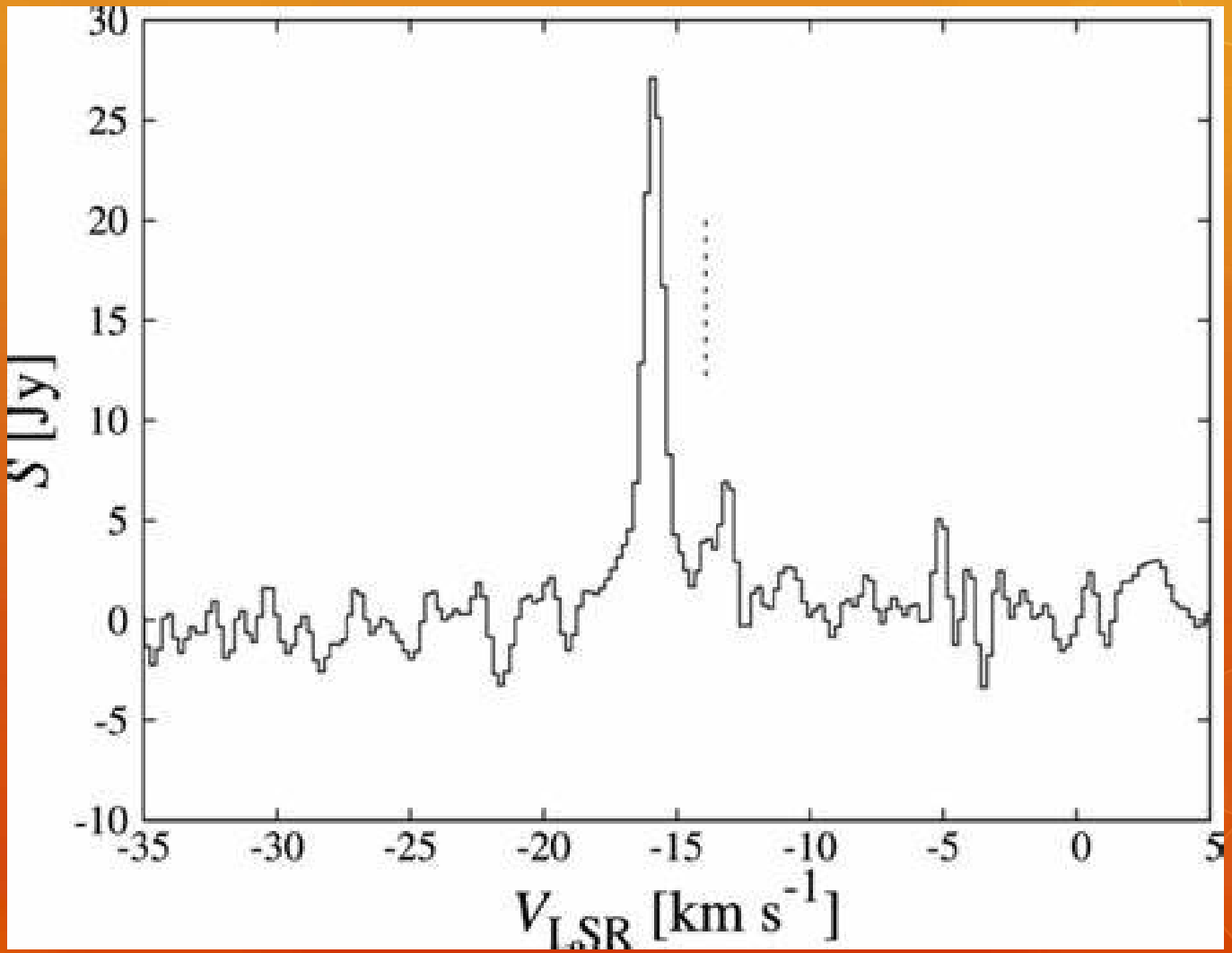
What has radio astronomy added to our knowledge of our univserse?

Imaging Black Holes

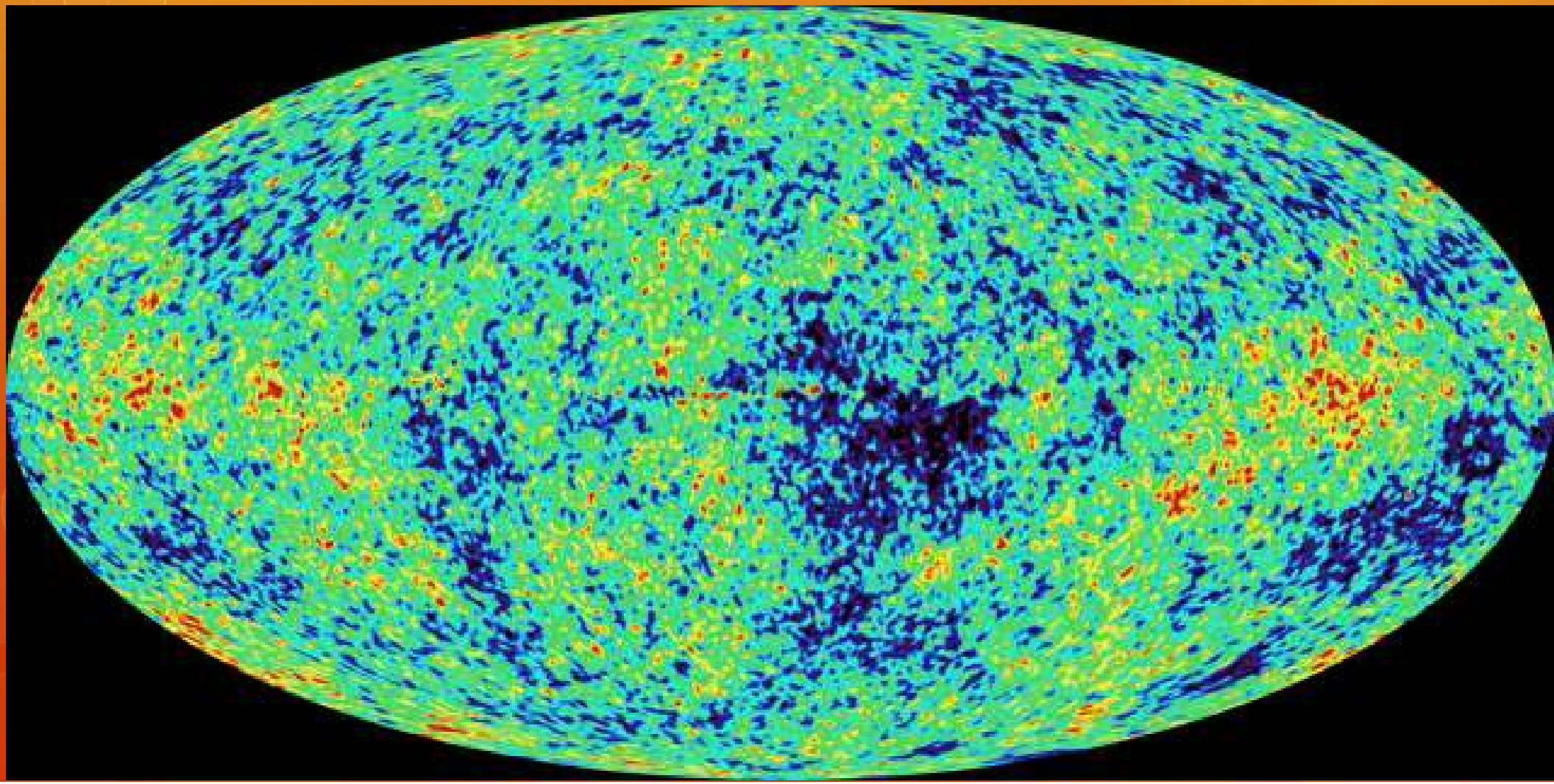


Non-Thermal Radiation from Galaxies

Coherent Maser Line Emission



Cosmic Microwave Background



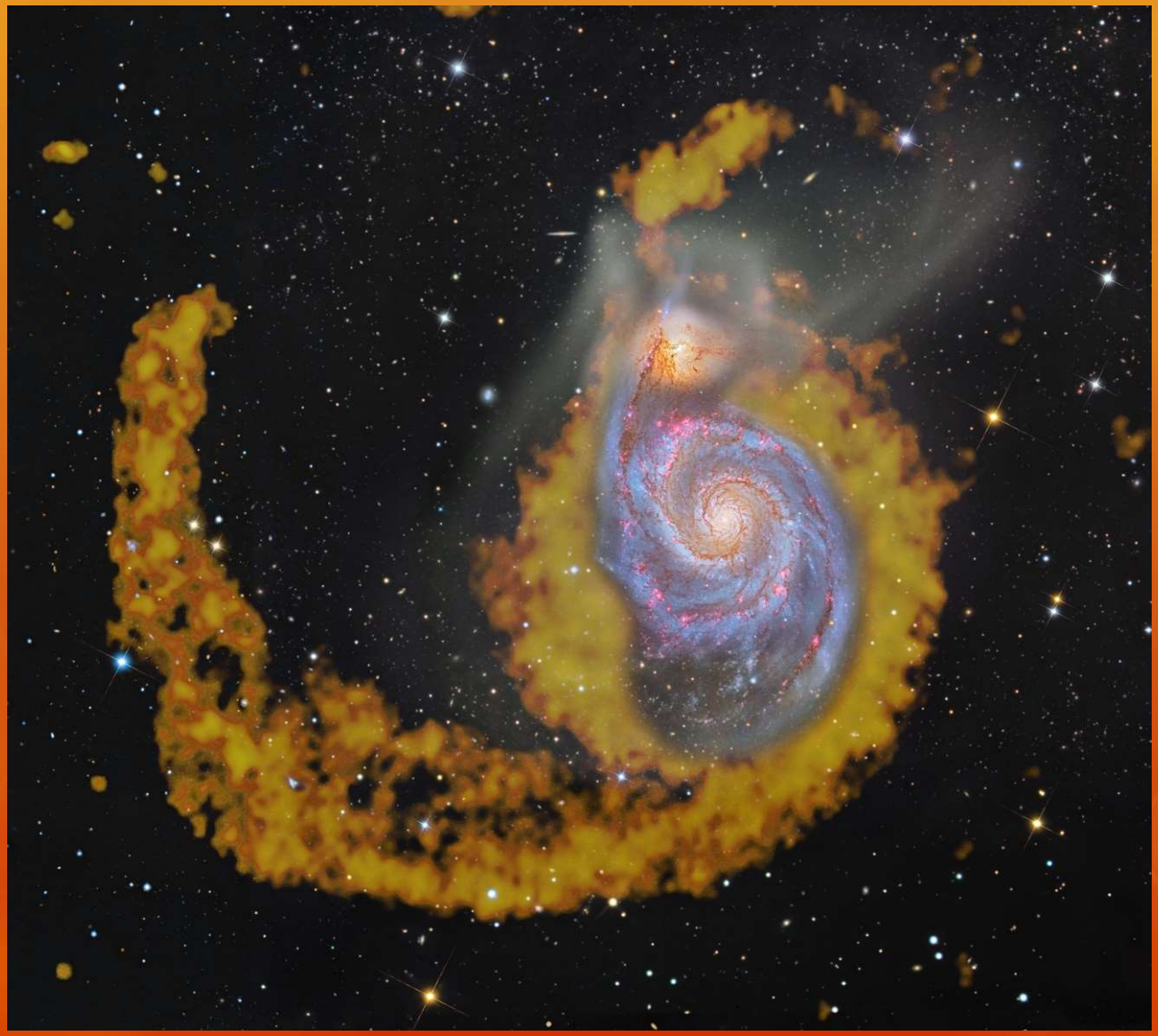
Neutron Stars (aka Pulsars)

B1933+16
0.356 S

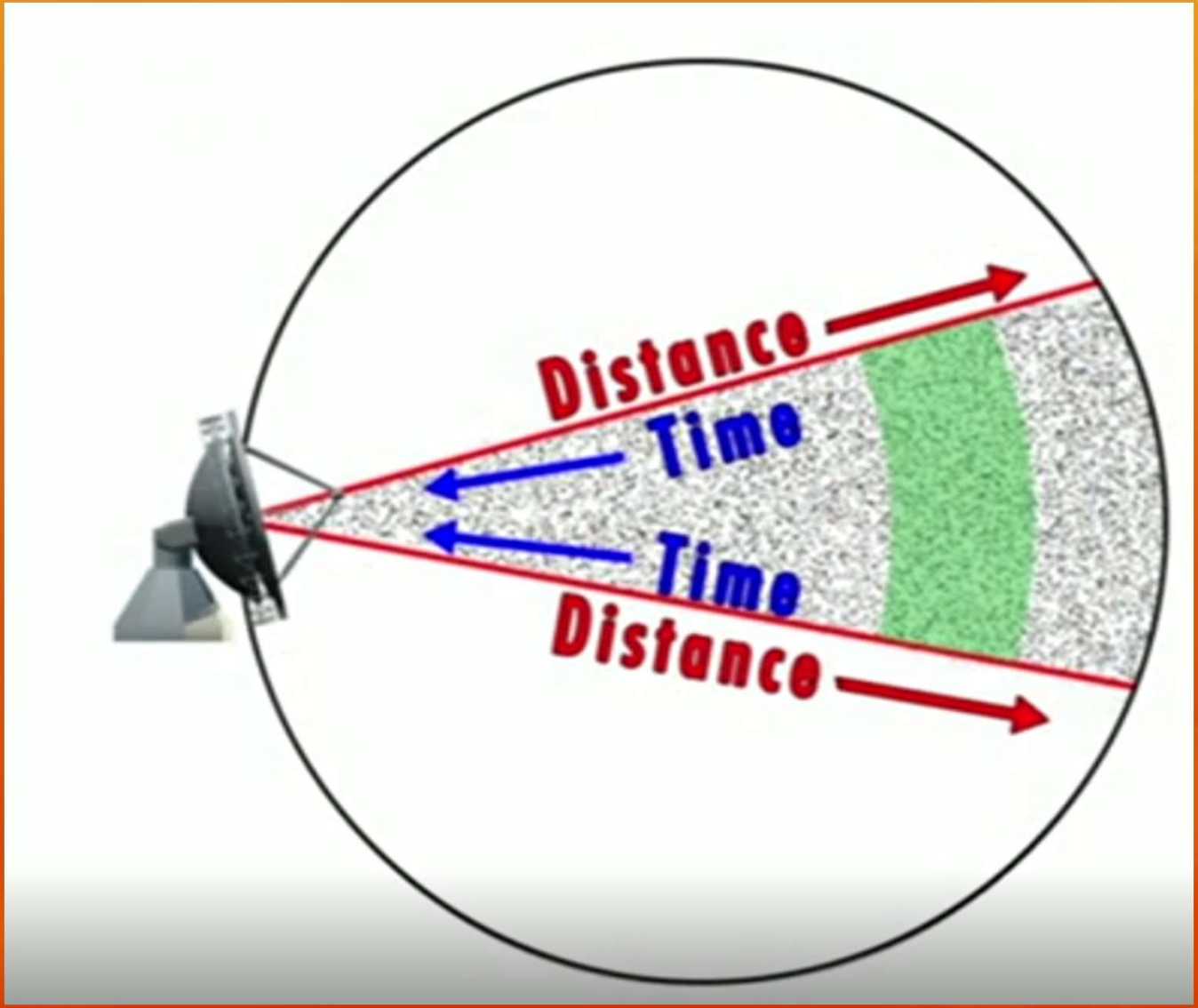
B0531+21
33.4 mS

B1937+21
1.56mS

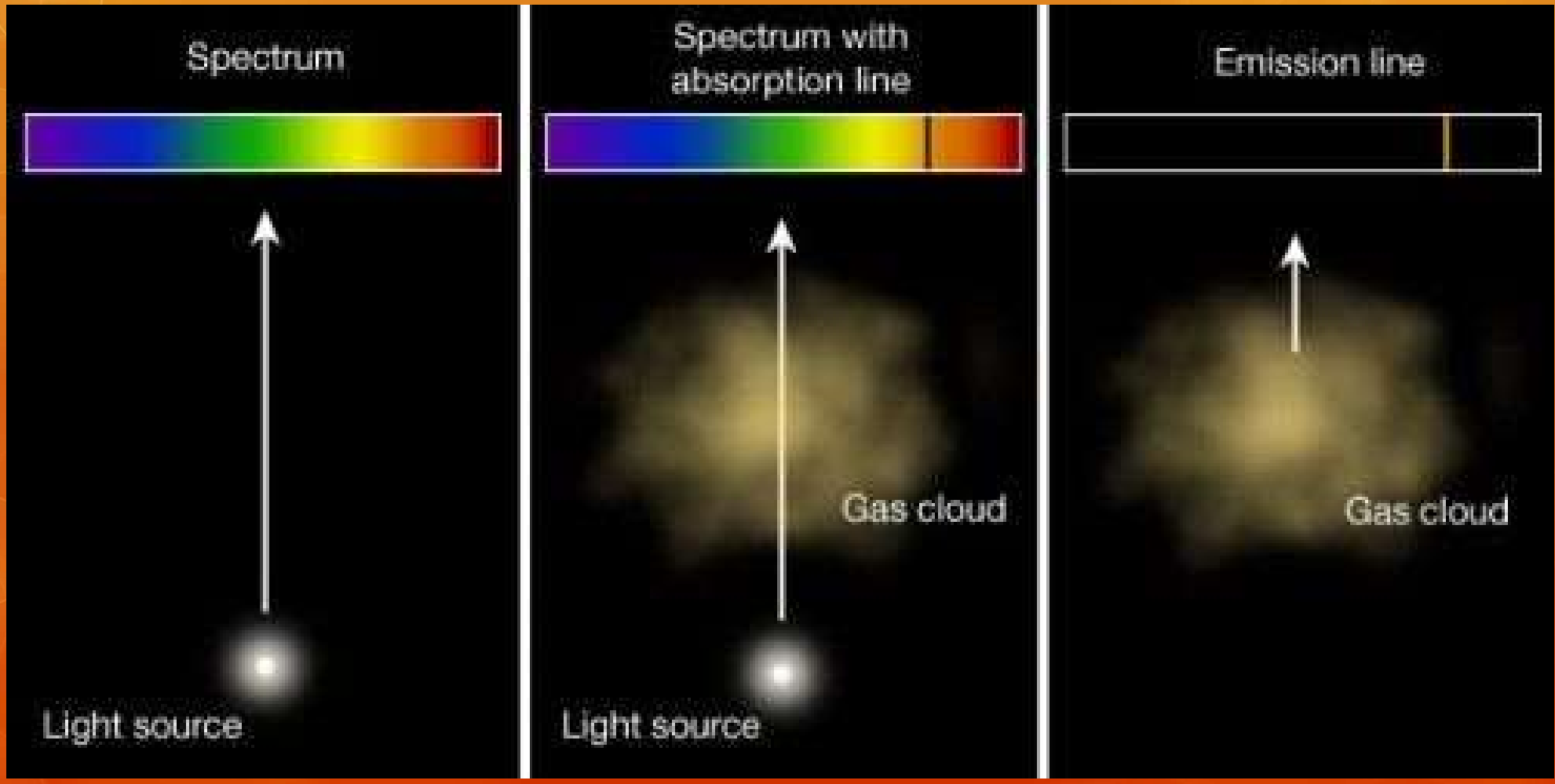
Galaxies extend way beyond their visible area…



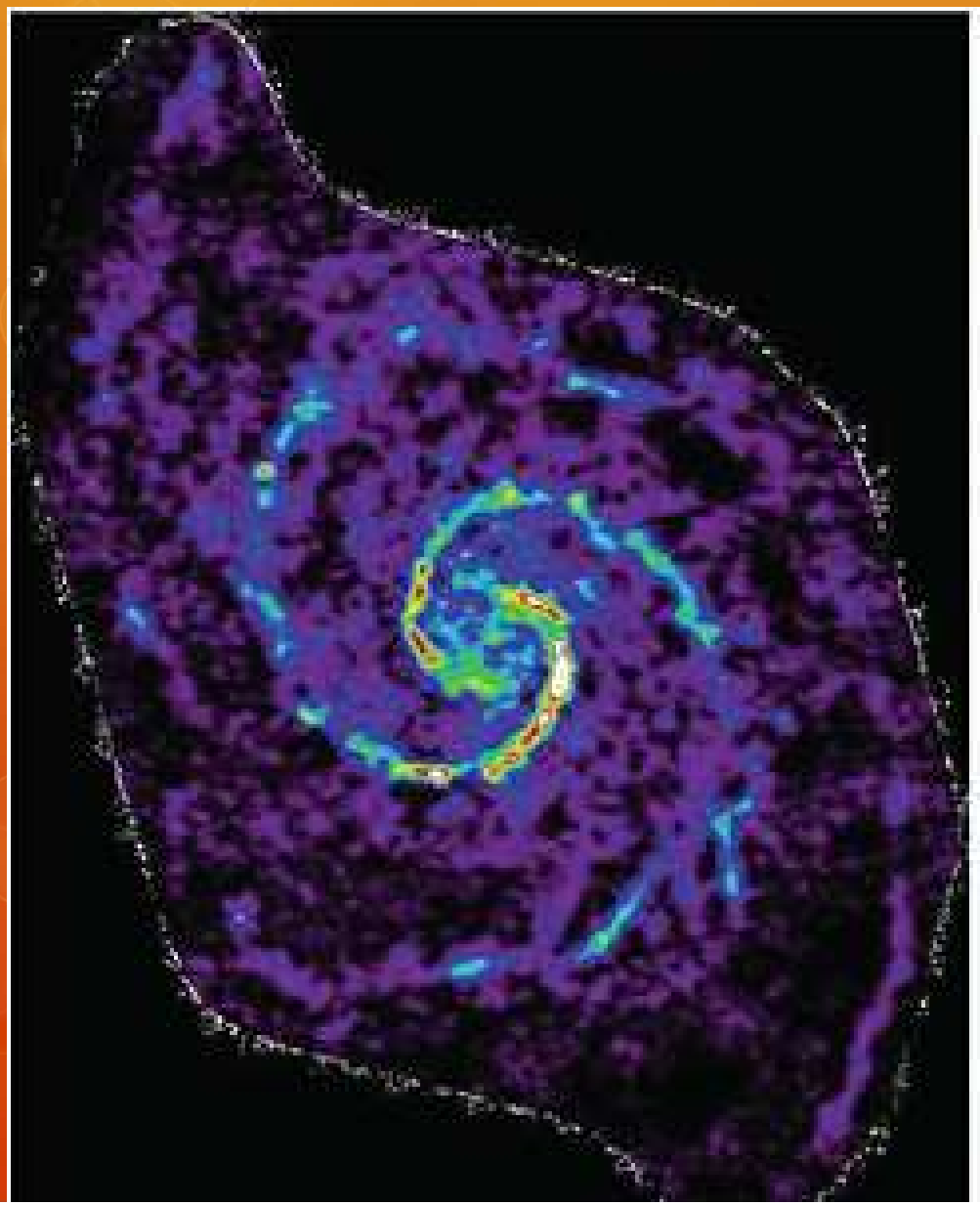
Evolution of Radio Galaxies and Quasars



Thermal spectral-line absorption and emission



Cold areas of galaxies

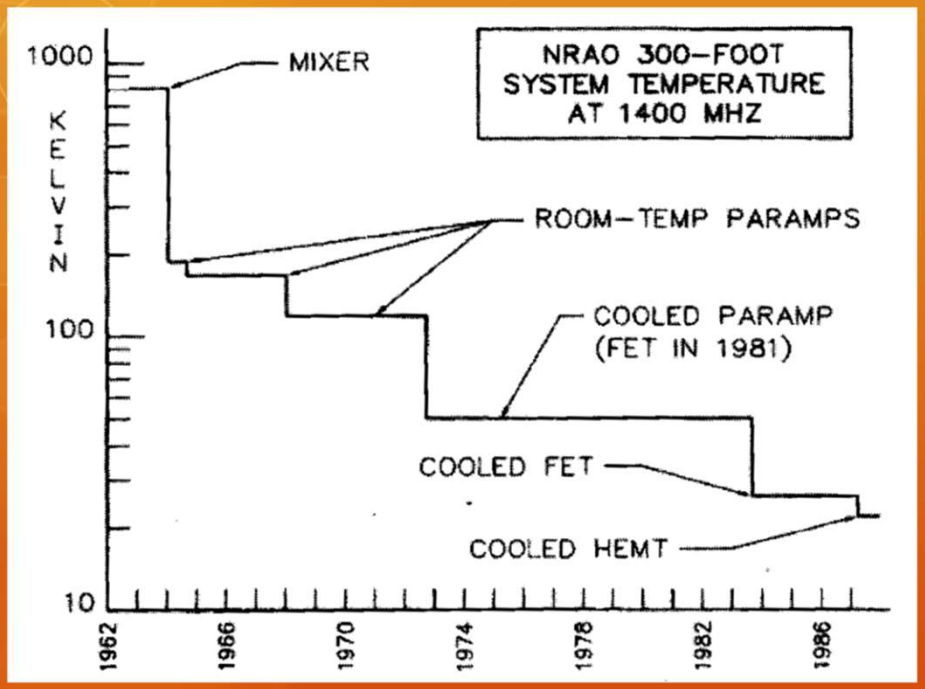


A peek into the nursery…

Technologies started in Radio Astronomy in everyday use…

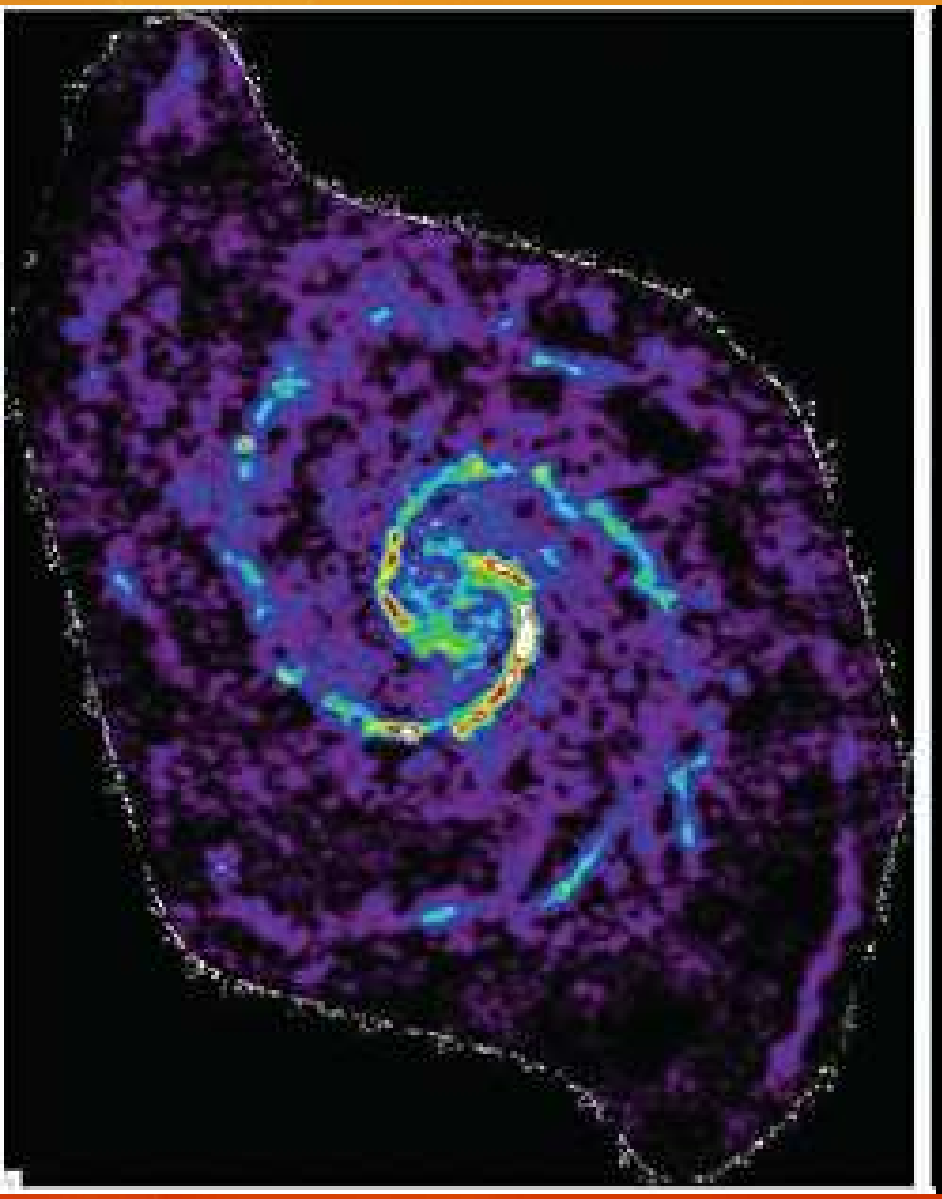
Time Keeping

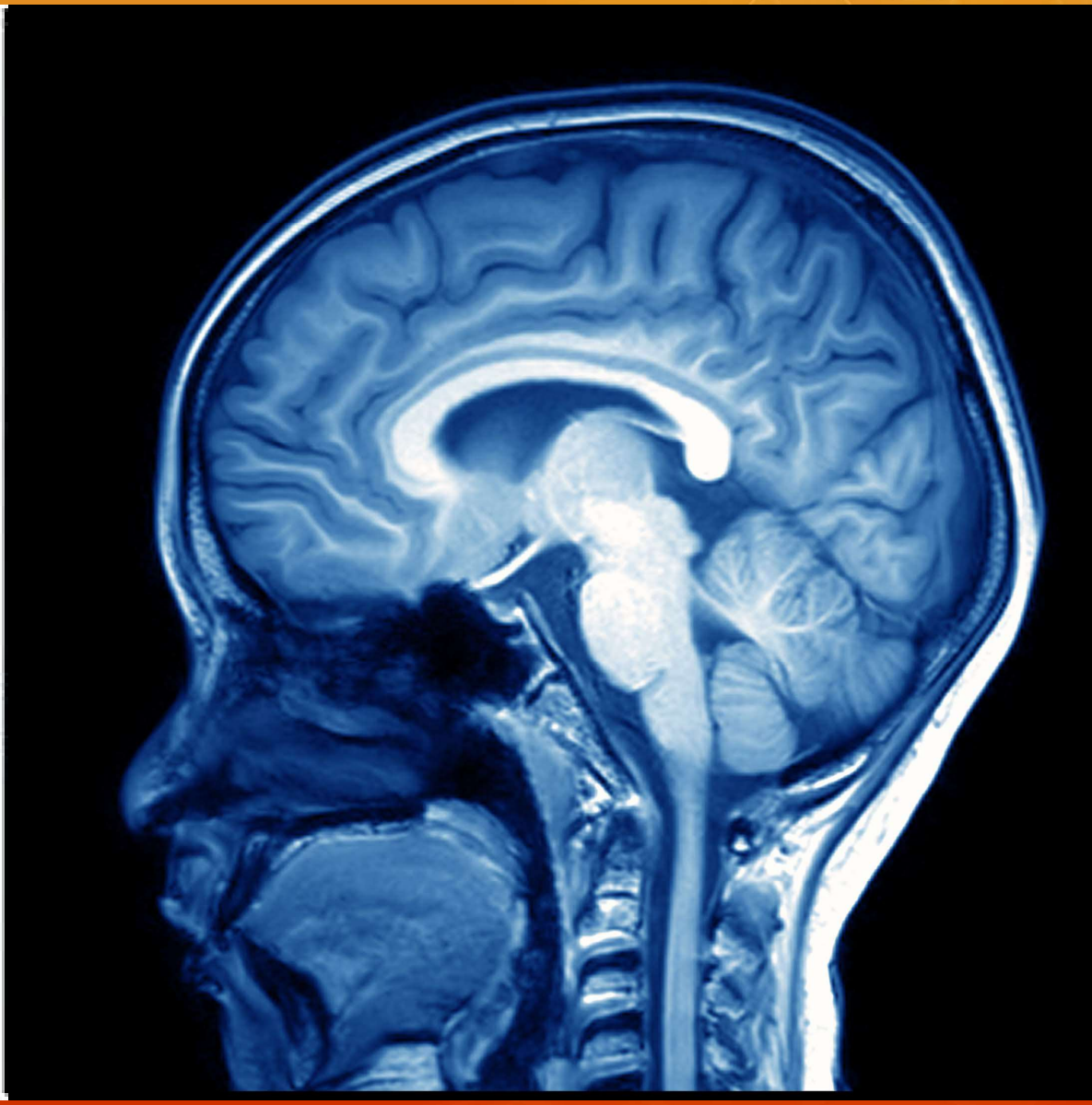
Amplifiers


NRAO 300-FOOT
SYSTEM TEMPERATURE
AT 1400 MHZ
1000
100
10
KELVIN
MIXER
ROOM-TEMP PARAMPS
COOLED PARAMP
(FET IN 1981)
COOLED FET
COOLED HEMT
1962
1966
1970
1974
1978
1982
1986

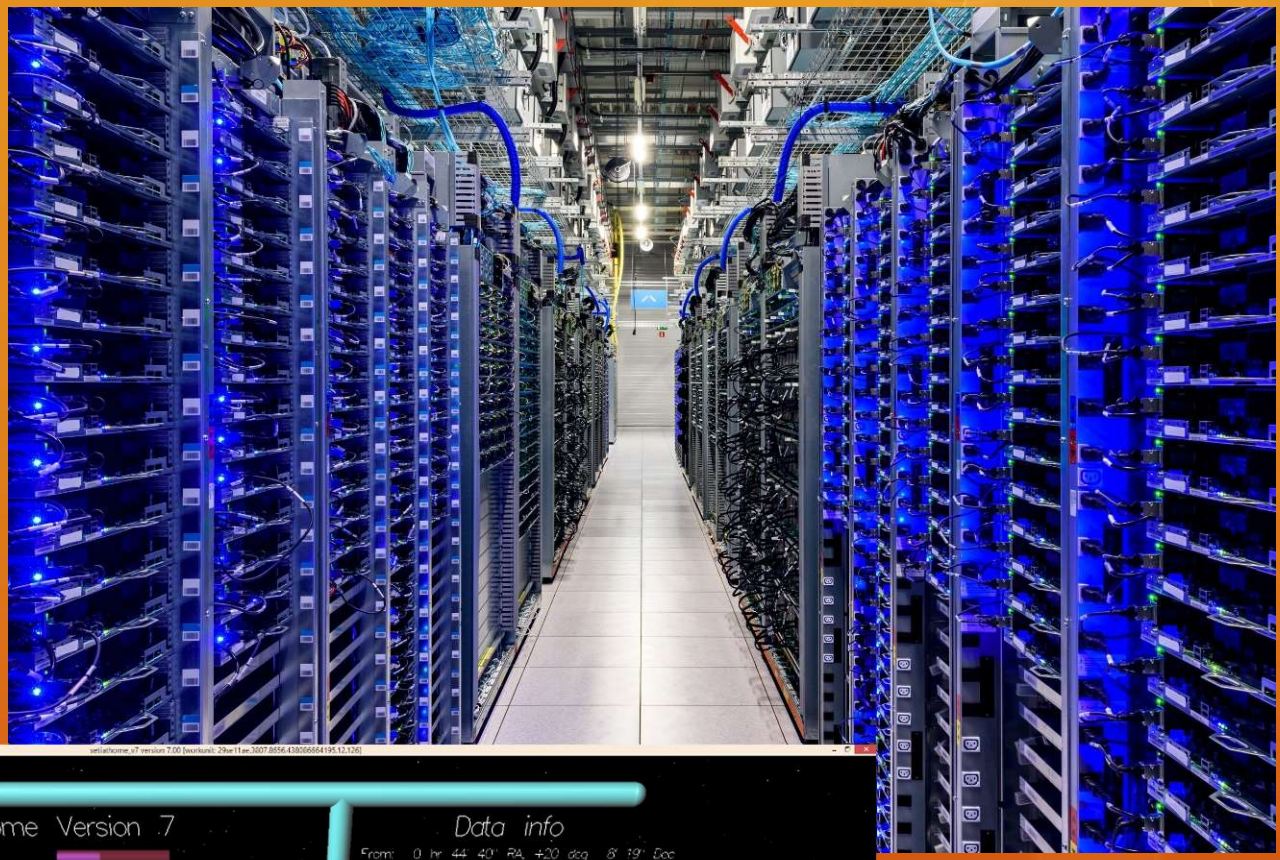

30MP27
Amperex

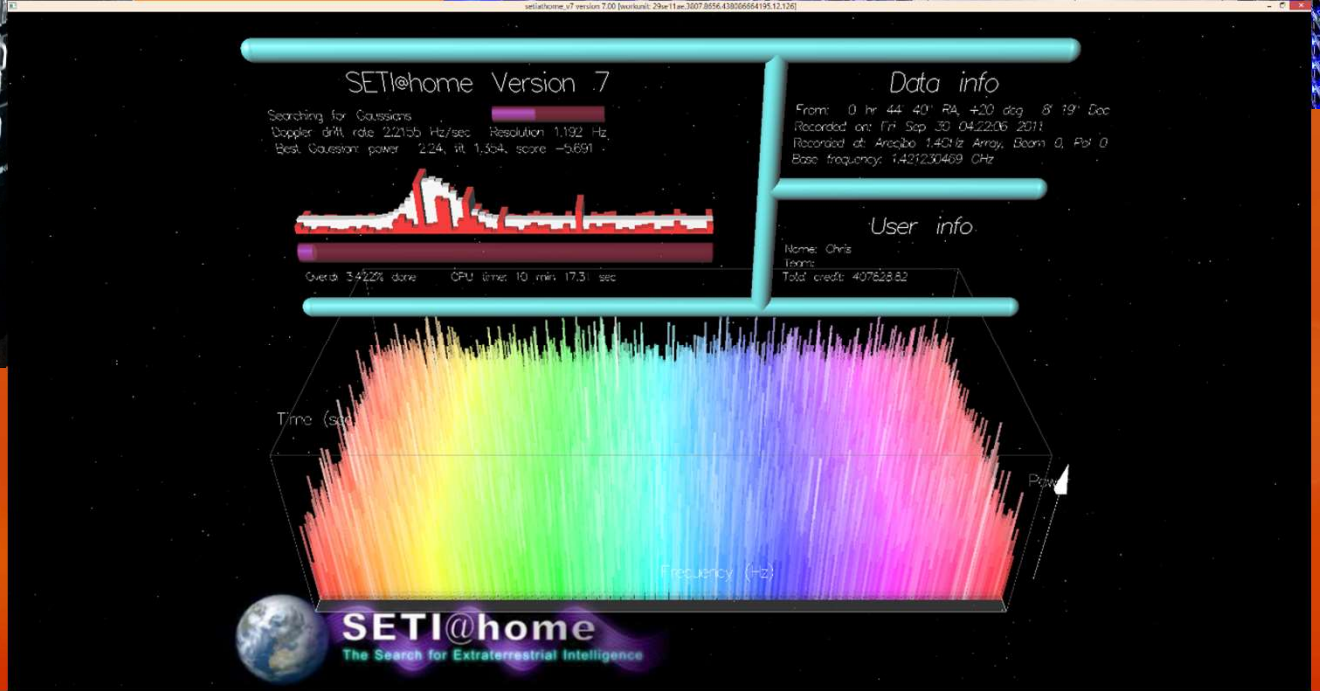
Imaging



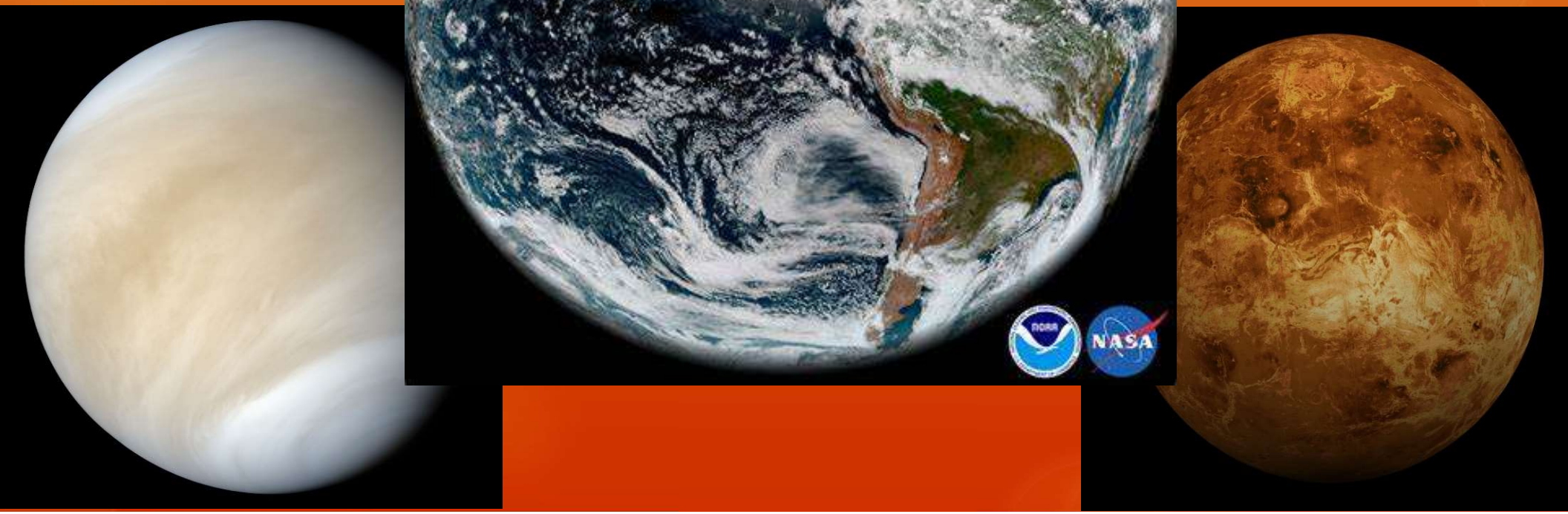


Computing

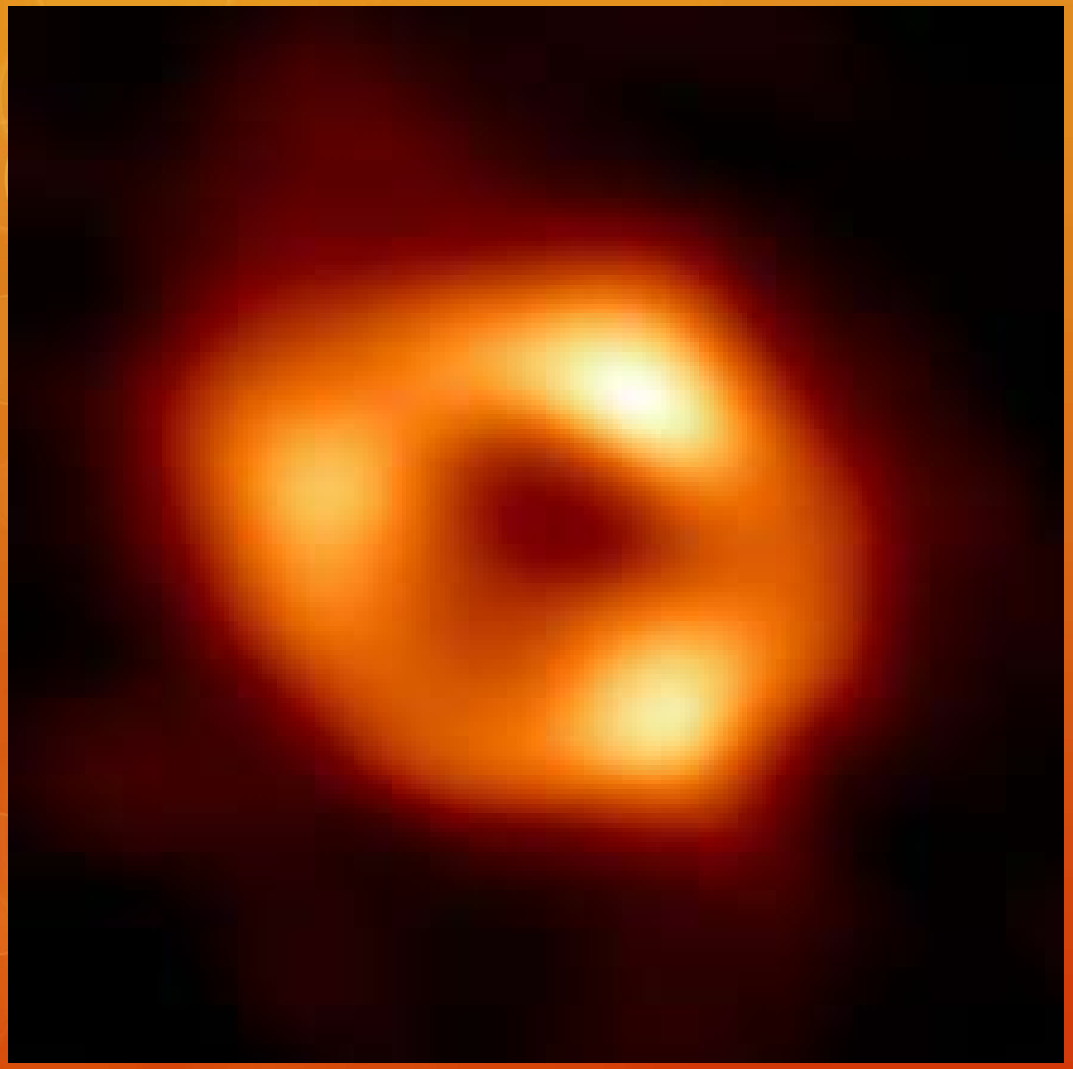



SETI@home Version 7
Searching for Gaussians
Data info
User info
SETI@home
The Search for Extraterrestrial Intelligence

Astmospheric Change



Wi-Fi



Pure Curiosity

SARA Forum:
https://groups.google.com/forum/#!forum/sara-list

WVAS
https://www.wvastro.org/

Questions?