

# SUNRISE

## GROUND RADIO LAB



Partnership Between





[sunrise.umich.edu](http://sunrise.umich.edu)



[radiojove.gsfc.nasa.gov](http://radiojove.gsfc.nasa.gov)

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**Training Module 1.5**

**Galactic Radio Emissions**

# Prerequisites for Training Modules

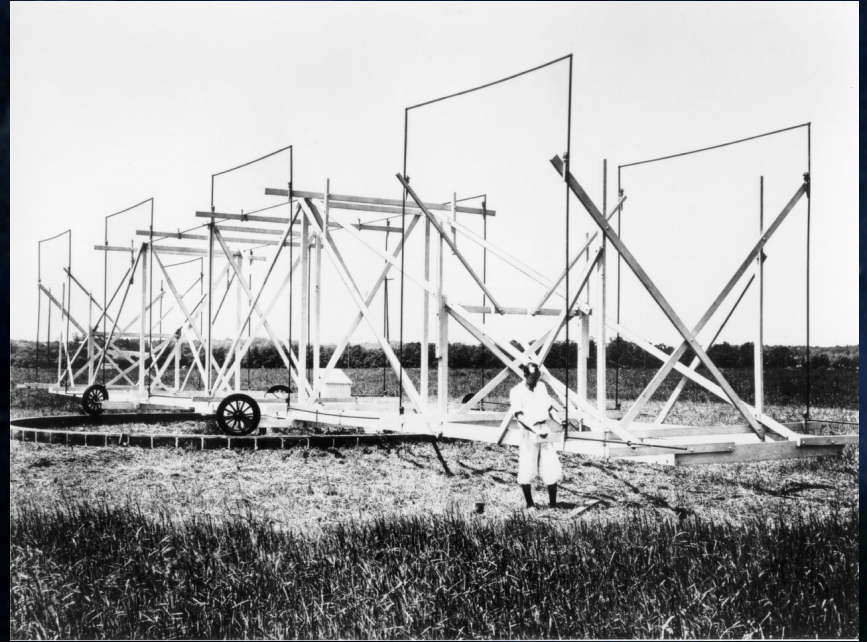
1. High School Reading Comprehension and General Science
2. Basic Geometry
3. Electromagnetic Spectrum
4. Speed, Wavelength, Frequency, and Energy of Waves
5. Graphical Interpretation of Data
6. Training Module 1.0-1.4

# Learning Objectives

- How Galactic radio emissions were discovered
- How the Galaxy is positioned
- Mechanism behind the generation of these emissions
- The Galactic Hump

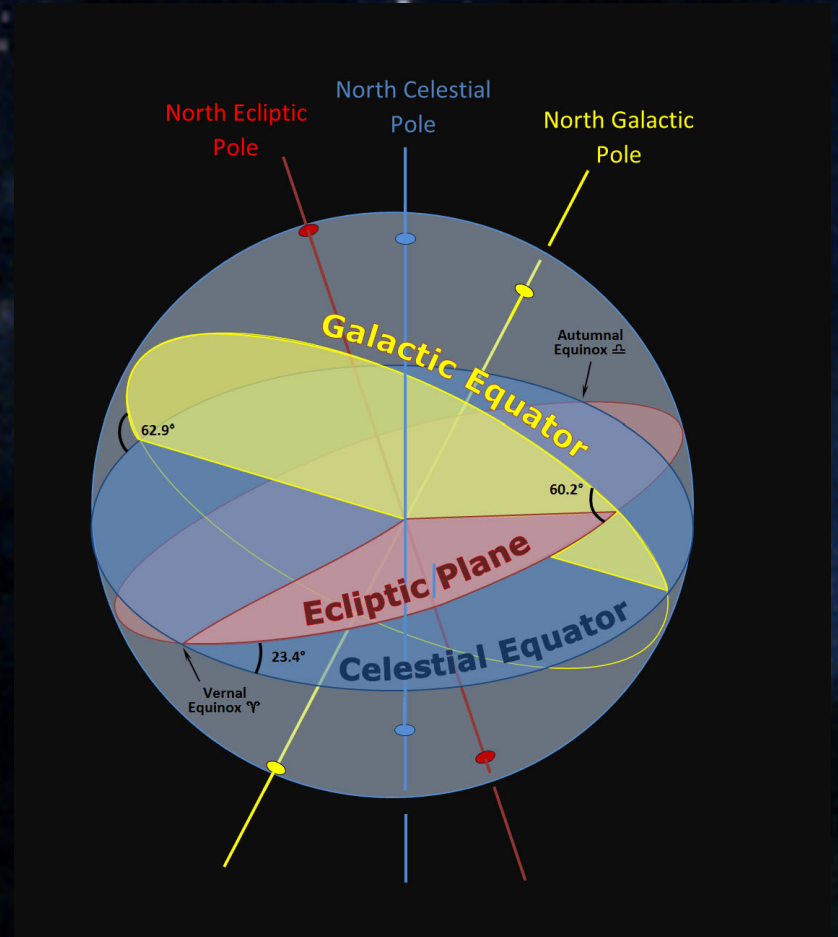
# Background

- Karl Jansky discovered the 20.5 MHz background radiation emitted by the galaxy in 1933 while searching for radio interference for Bell labs.
- The direction of the radiation changed over the course of the day and the source peak was towards Sagittarius, the Galactic Center.
- Radio astronomy was ultimately born from this discovery!



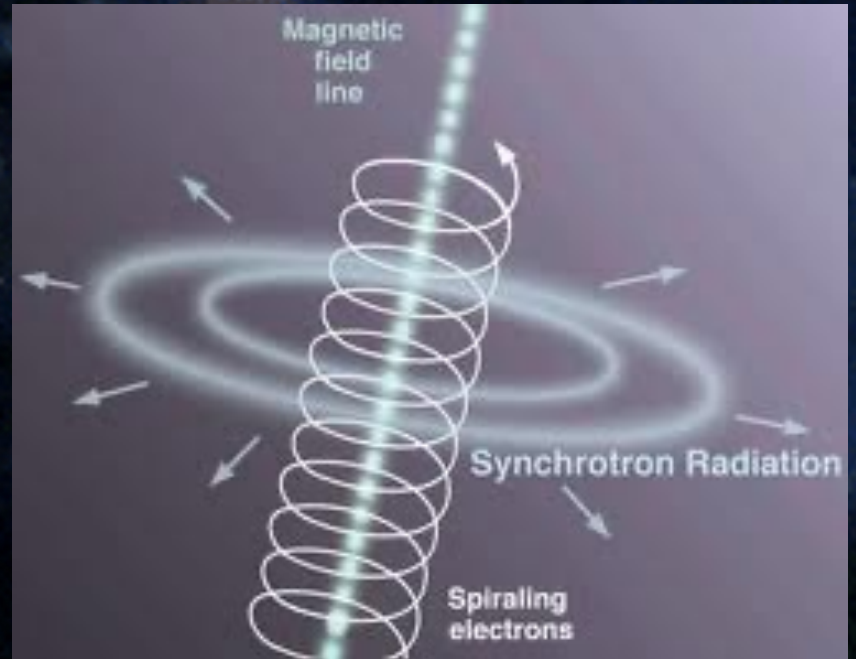
# The Position of our Galaxy

- Our Galaxy is a thin disk of stars, gas, and dust, and is inclined by  $63^\circ$  to our celestial equator.
- This inclination causes the Galaxy to pass overhead once every 12 hours.
- Every other transit is pointed towards the Galactic Center where the radiation is more intense.



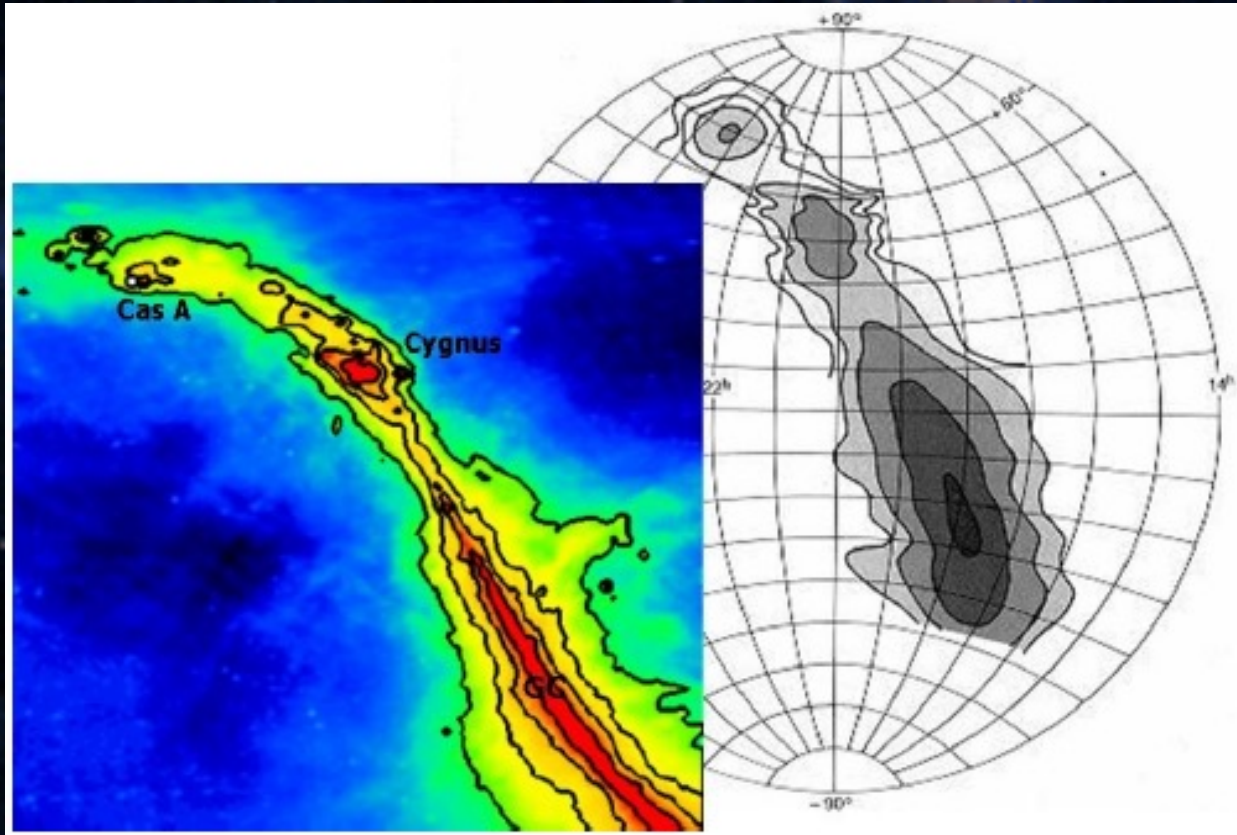
# Galactic Radio Emissions

- So, why do we receive background radiation from our Galaxy?
- Our galaxy has weak magnetic fields less than the strength of the Earth's magnetic field.
- When charged particles are accelerated to relativistic speeds as they spiral along magnetic field lines, they generate synchrotron radiation at frequencies less than 30 MHz.



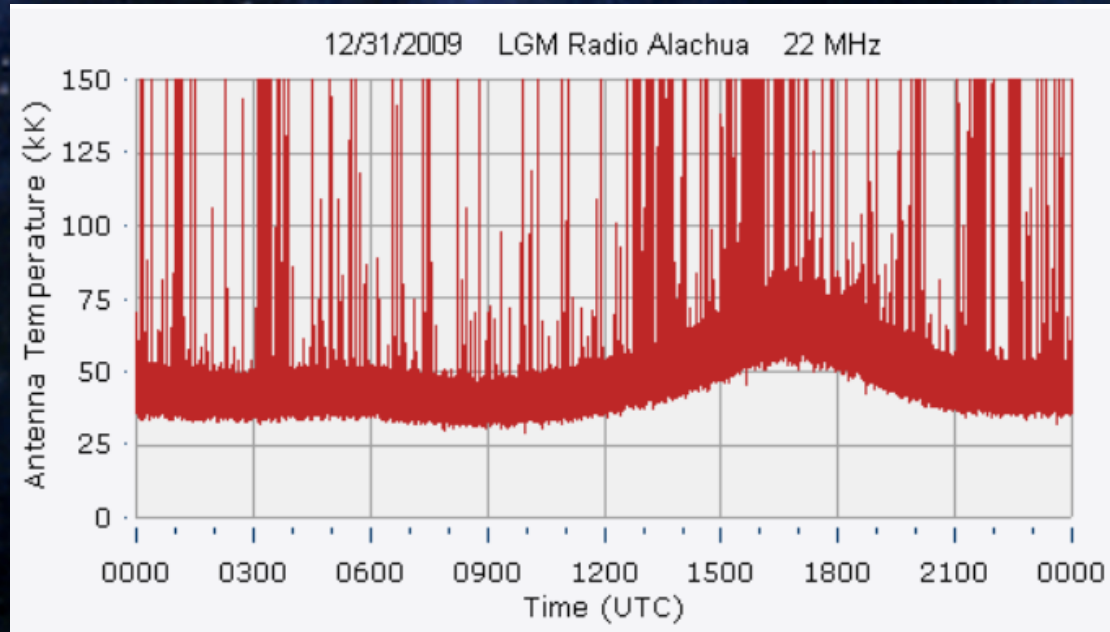


# Detecting Galactic Radio Emissions - Reber

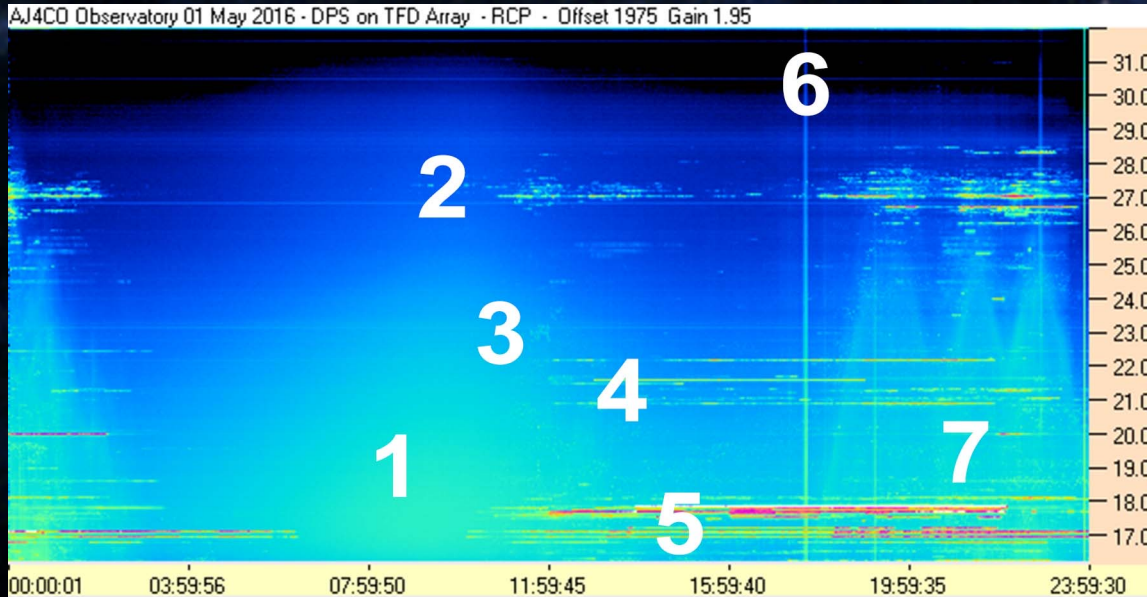


# Detecting Galactic Synchrotron Emission

- The Radio Jove receivers can detect low frequency Galactic radio emissions.
- In a 24-hour period, two distinct “Galactic humps” can be observed.
- The Galactic hump at 1650 UTC represents a view towards the Galactic Center.



# A 24-hour spectrogram of the upper HF band on 01 May 2016.



- Numbers indicate the following emission signatures:
- 1 – Gradual brightening and decay shows the galactic plane passing overhead.
- 2 – Horizontal lines show citizen’s band radio communications.
- 3 – Small dots indicate HF radar emission.
- 4 – Horizontal lines show amateur radio and shortwave broadcast signals.
- 5 – Horizontal lines show shortwave broadcast signals.
- 6 – Vertical line shows a solar radio burst.
- 7 – Three triangular, teepee-shaped, overlapping areas show time-varying increase in so-called “band noise” due to terrestrial ionospheric propagation effects enabling natural emission from distant lightning to be received at the observatory.

# Resources

## Karl Jansky

- <https://public.nrao.edu/gallery/karl-jansky-and-his-merrygoround/>
- [https://www.gb.nrao.edu/~fghigo/JanskyAntenna/RepeatingJansky\\_memo10.pdf](https://www.gb.nrao.edu/~fghigo/JanskyAntenna/RepeatingJansky_memo10.pdf)

## Galactic Hump

- <https://radiojove.gsfc.nasa.gov/library/pubs/docs/Fun-Experiment-1.pdf>
- [https://radiojove.gsfc.nasa.gov/library/sci\\_briefs/galactic.htm](https://radiojove.gsfc.nasa.gov/library/sci_briefs/galactic.htm)

## Galactic Synchrotron Radiation

- [https://ned.ipac.caltech.edu/level5/Condon/condon4\\_1.html](https://ned.ipac.caltech.edu/level5/Condon/condon4_1.html)

**Thanks for your attention!**

