



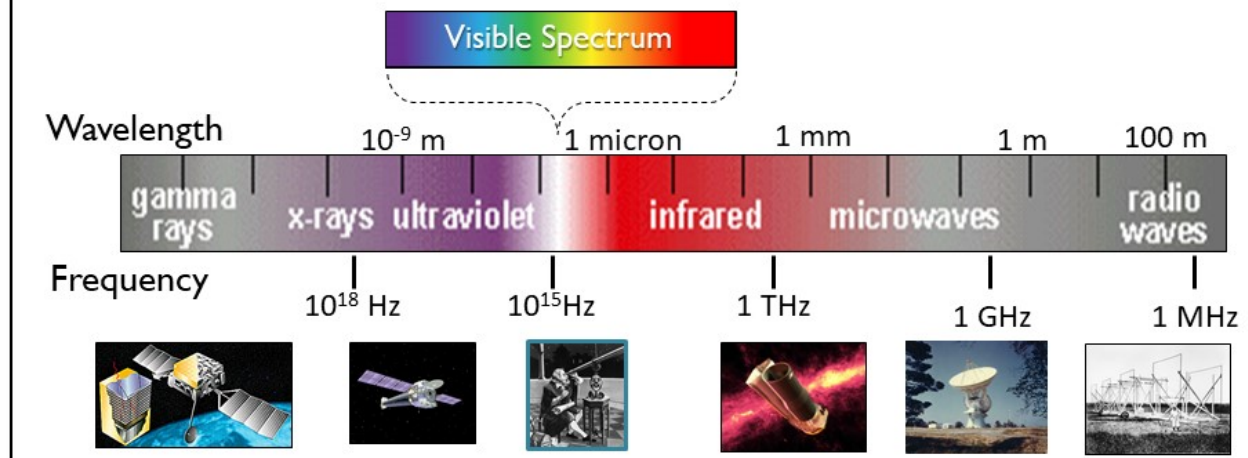
# Karl Jansky and the Beginning of Radio Astronomy

*Ken Kellermann  
NRAO*

27 April 2023



# Electromagnetic Spectrum



# Karl Jansky

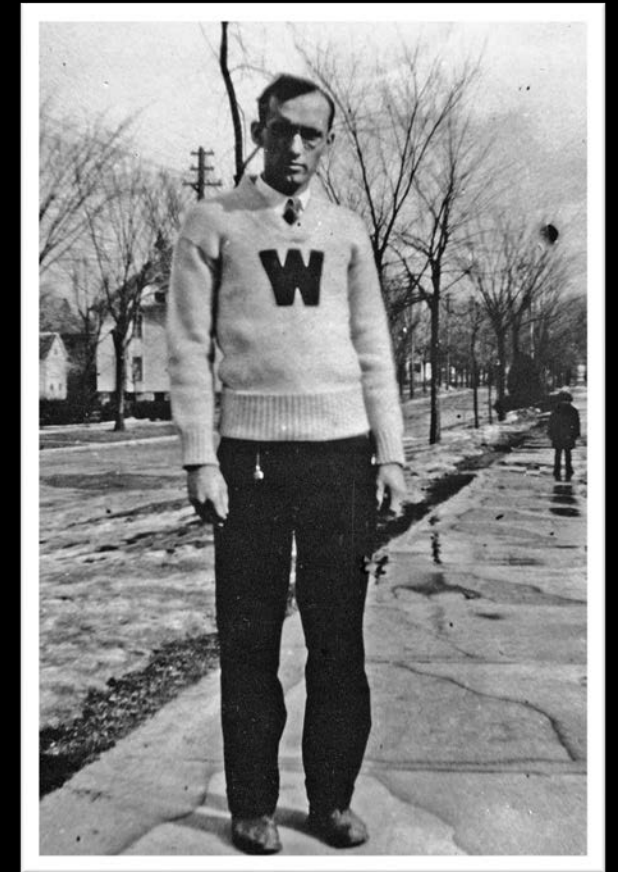
Born 25 October 1905 – Oklahoma Terr.

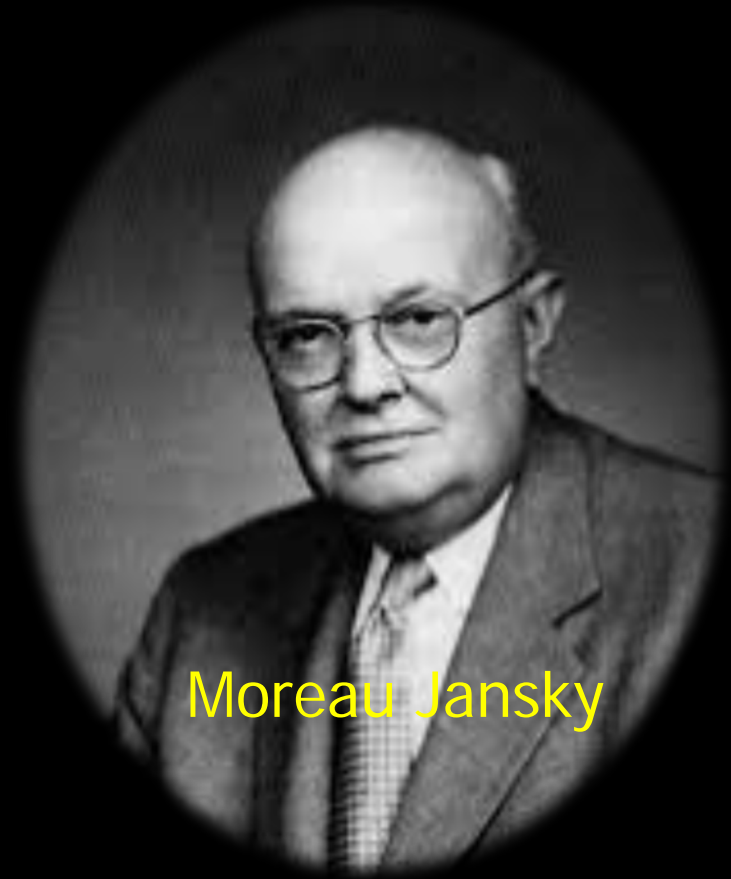
Grew up in Madison, Wisconsin

Went to the University of Wisconsin

Rejected for U of W ROTC program

Graduated BS Physics Phi Beta Kappa 1927





Moreau Jansky

University of Minn. professor  
Former Bell Labs employee  
Later to become president IRE



ATT Bell Laboratories  
New York City Headquarters

# Bell Labs – Cliffwood Beach, NJ



- Long distance domestic telephone service
  - copper wires and repeaters
- No undersea cables – No satellites
- 1927 ATT started long wave radio transatlantic service
  - 60 kHz (5 km) wavelength
  - 200 kw water-cooled transmitter
    - 20 X 10 KW
    - SSB
  - Expensive: \$75 for a 3 min call
  - Unreliable: equipment, season, static
  - Limited bandwidth



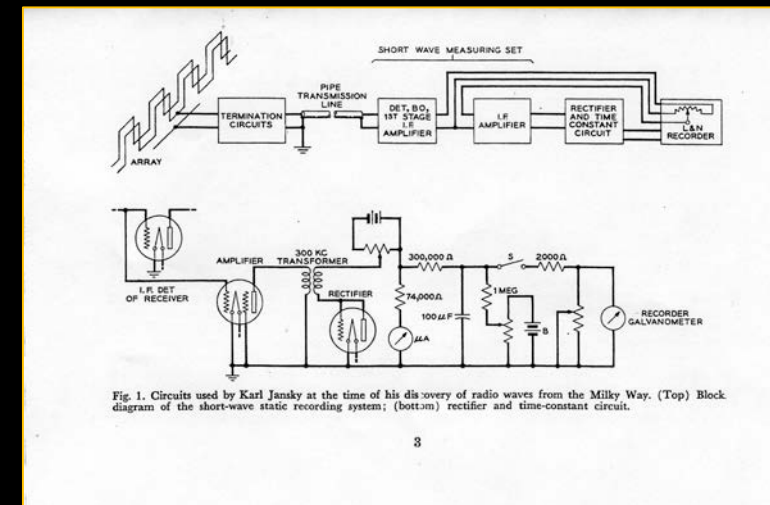
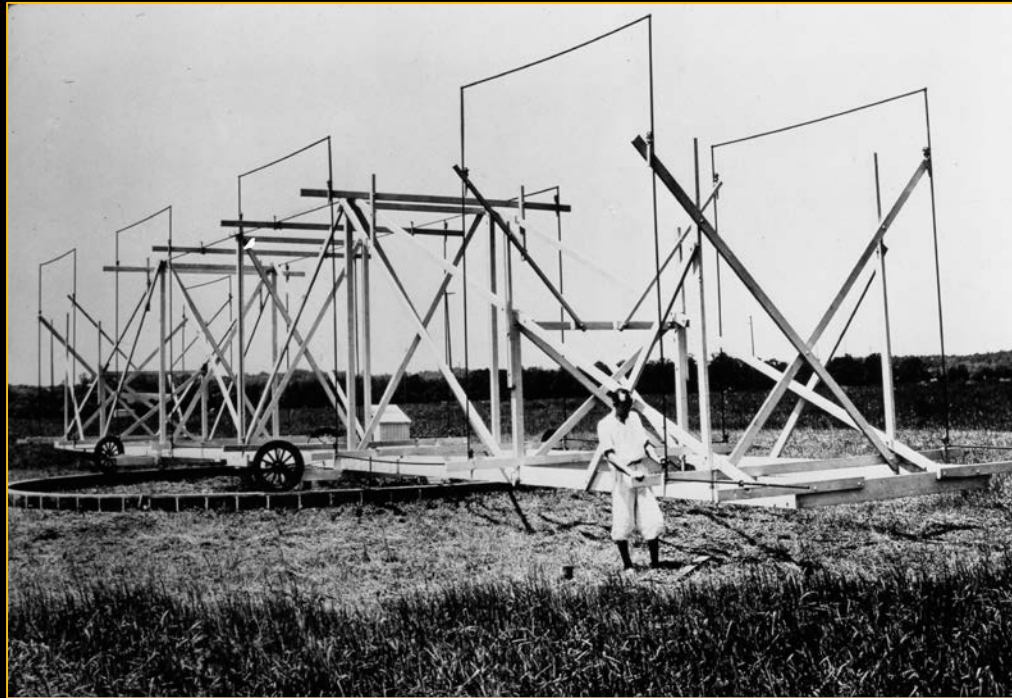
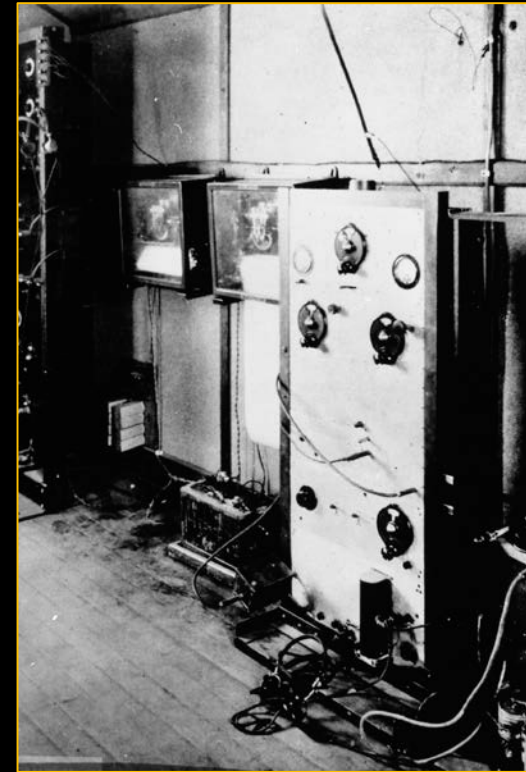
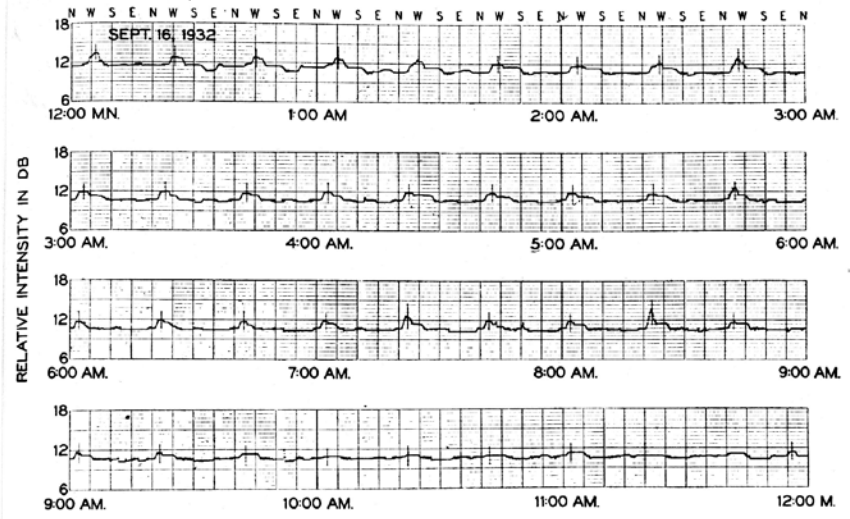
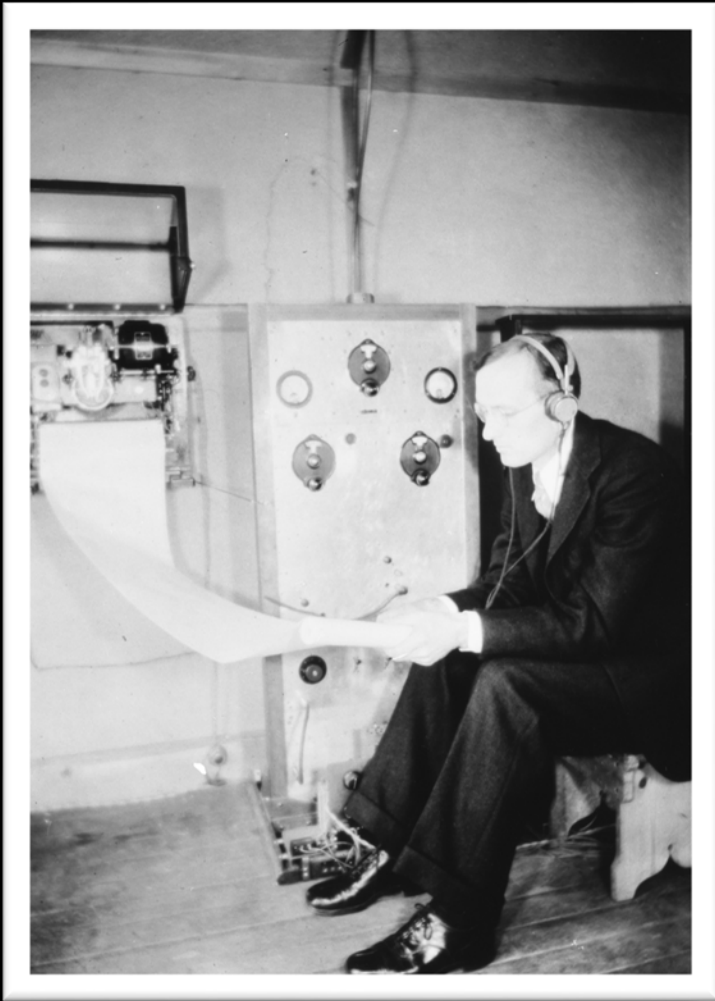


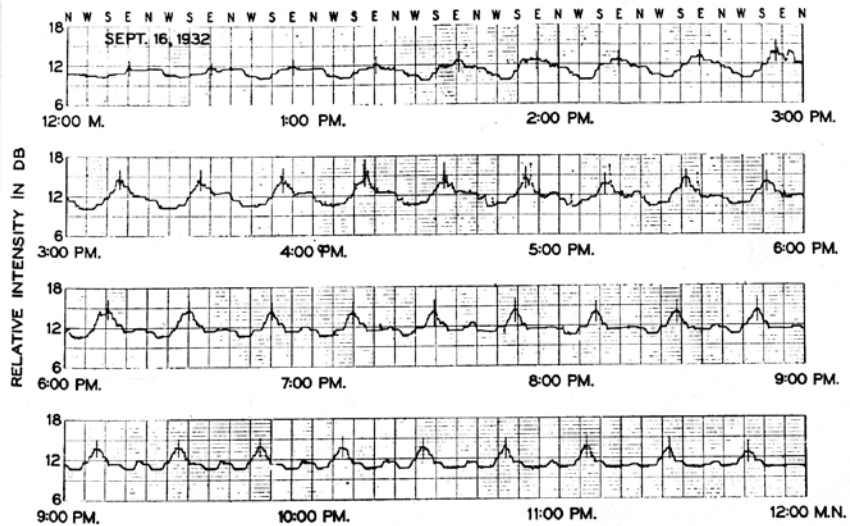
Fig. 1. Circuits used by Karl Jansky at the time of his discovery of radio waves from the Milky Way. (Top) Block diagram of the short-wave static recording system; (bottom) rectifier and time-constant circuit.



20.6 MHz (14.6 m) Bruce Array  
 36 x 24 degree beam – 15 deg elevation  
 Model T Ford tires  
 Rotated every 20 min  
 10 sec time constant



### Proc. IRE





# First results

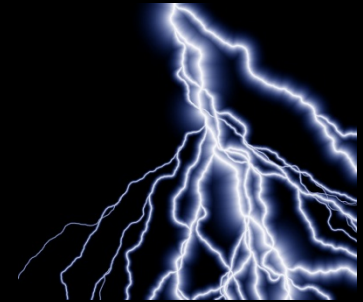
The peculiar thing about this "static" is that the direction from which it comes changes gradually and what is most interesting always comes from a direction that is the same or very nearly the same as the direction the sun is from the antenna.

18 January 1932: The peculiar thing about this static is that the direction from which it comes gradually changes and what is most interesting is that it always comes from a direction that is the same or nearly the same as the direction the sun is from the antenna.

# Directional Studies of Atmospheric at High Frequencies USNC URSI –April 1932

## Three sources of interference

- Local thunderstorms
- Distant thunderstorms
- A very steady hiss type static  
the origin of which is unknown



# Star Noise - Feb 14, 1933

*I my records show that the hiss type static mentioned in my previous paper comes, not from the sun as I suggested in that paper, but from a direction fixed in space. The evidence I now have is very conclusive and, I think, very ~~startling~~ startling.*

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## Star Noise



Harald Friis

*Friis will not let me make a definite statement, but says I must use the expression 'apparently fixed in space' or 'seems' to come from a fixed direction.*

APPENDIX C. PROGRAM OF ANNUAL MEETING, APRIL 27, 1933.

National Academy of Sciences Bldg.,  
2101 Constitution Avenue,  
Washington, D. C.

(There were two sessions, beginning at 10 A.M. and 2 P.M. Papers limited to 12 minutes each, to allow time for discussion. The meeting this year was featured by a special commemoration of the life and work of Dr. L. W. Austin, who founded the American Section).

Program.

Resolution and remarks in honor of Dr. L. W. Austin. By Dr. A. E. Kennelly (President of the U.R.S.I.), Capt. S. C. Hooper (representing the Navy Dept.), and Dr. A. H. Taylor (representing the Institute of Radio Engineers).

The effect of the electrical properties of the earth on the radiation from a simple antenna. L. P. Wheeler (Naval Research Laboratory).

A decade system for frequency comparisons. R. M. Page (Naval Research Laboratory).

Measurement of piezo-resonator constants by an impedance method. W. G. Cady (Wesleyan University).

A magnetostriction filter. Harry H. Hall (introduced by Prof. E. L. Chaffee). (Harvard University).

Audio frequency atmospherics. E. T. Burton (Bell Telephone Laboratories).

A note on hiss type atmospheric noise. K. G. Jansky (Bell Telephone Laboratories).

A compact direction finder for atmospheric disturbances. W. B. Burgess (Naval Research Laboratory).

Some earth potential measurements being made in connection with the International Polar Year. G. C. Southworth (American

*Meant nothing to anybody*

*URSI is "an almost  
defunct organization  
...attended by a mere  
handful of old college  
professors."*

May 5, 1933

# NEW RADIO WAVES TRACED TO CENTRE OF THE MILKY WAY

Mysterious Static, Reported by K. G. Jansky, Held to Differ From Cosmic Ray.

DIRECTION IS UNCHANGING

Recorded and Tested for More Than Year to Identify it as From Earth's Galaxy.

# WJZ



4/27/2023

**The New York Times.** LATE CITY EDITION

VOL. LXXXIII... No. 27,608... NEW YORK, FRIDAY, MAY 5, 1933. TWO CENTS

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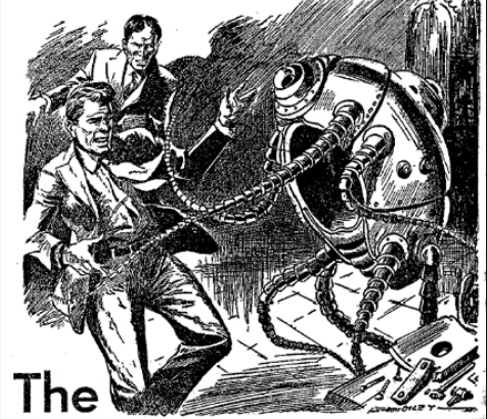
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# Hundreds of Newspapers

## Time Magazine Life New Yorker Nature

From the Nethermost Regions of Space Visitors by Proxy Search for Earth's Most Pricelss Possession!





# The COSMIC HISS

By EDMOND HAMILTON

Author of "Space Mirror" "Power Pit 13," etc.



- 
- June - IRE Convention (Chicago)
    - *Electrical Disturbances of Apparently Extraterrestrial Origin*
    - *Proc. IRE, 21, 1387 (1933)*
  - *Popular Astronomy*
    - *Electrical Phenomena that Apparently are of Interstellar Origin*
  - *Nature – Radio Waves from Outside the Solar System*
  - October –Museum of Natural History - *Hearing from the Radio Stars*



I have definite proof that the waves come from the Milky Way. However, I am not working on the interstellar waves any more. Friis has seen fit to make me work on the problems and methods of measuring noise in general. ... Not very interesting as the interstellar waves, nor will it bring me near as much publicity. I am going to do a little bit of theoretical research on my own at home.

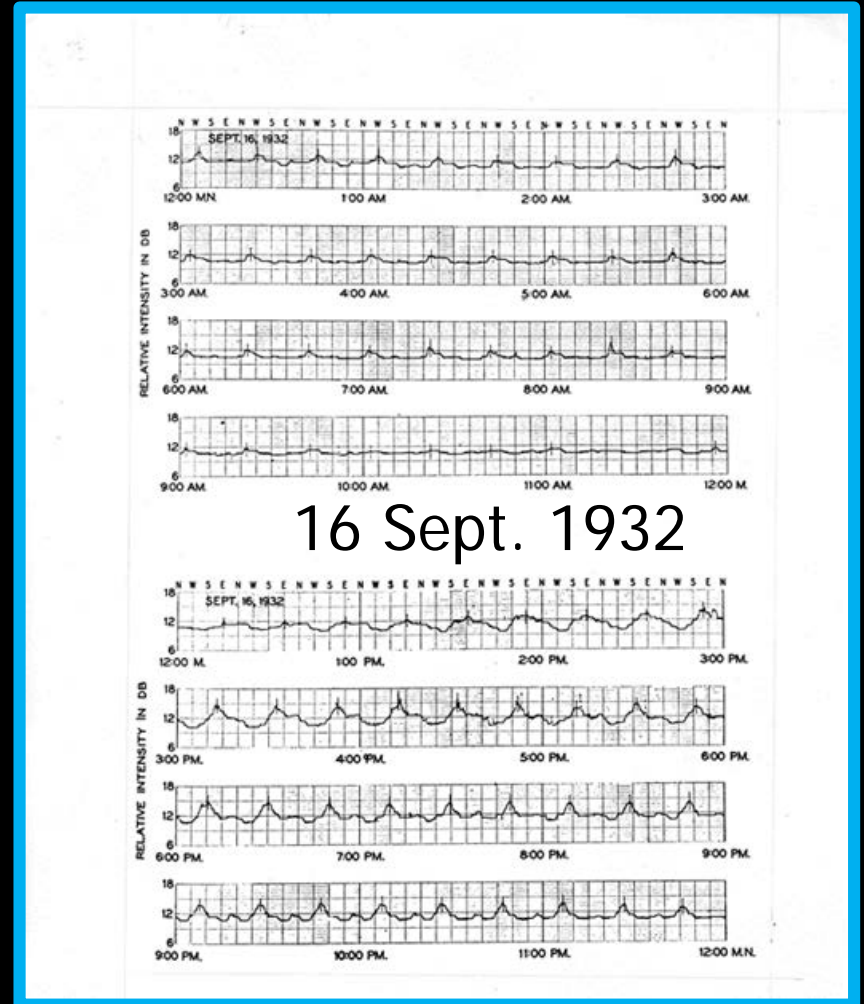
*Karl Jansky to his parents 22 Jan 1934*



# A Note on the Source of Stellar Interference

Proc. IRE, 23, 1158 (1935)

- Large and small peaks associated with center and anti-center regions of the Galaxy
- Broad peaks when scan is along direction of the Galactic Plane
- Noise (hiss) similar to receiver noise (Thermal) agitation of electrons stars or ISM).
- "Classes of heavenly bodies" where the ratio of radio to light is much greater than for the sun





Yes, it is very  
interesting, but it's  
done  
Nothing left to do

Joel Stebbins, Madison Wisconsin

Compared Jansky's discovery with Charles  
Lindbergh' solo flight across the Atlantic  
"only greater."



Fred Whipple



Jesse Greenstein



Harvard College  
Observatory

Whipple, F. L. and Greenstein, J.L. 1937  
On the Origin of Interstellar Radio Disturbances  
*PNAS*, **23**, 177

**Jansky's observations not  
consistent with B-B radiation!**

1937: Jansky investigated  
limits to receiver sensitivity  
resulting from star noise.



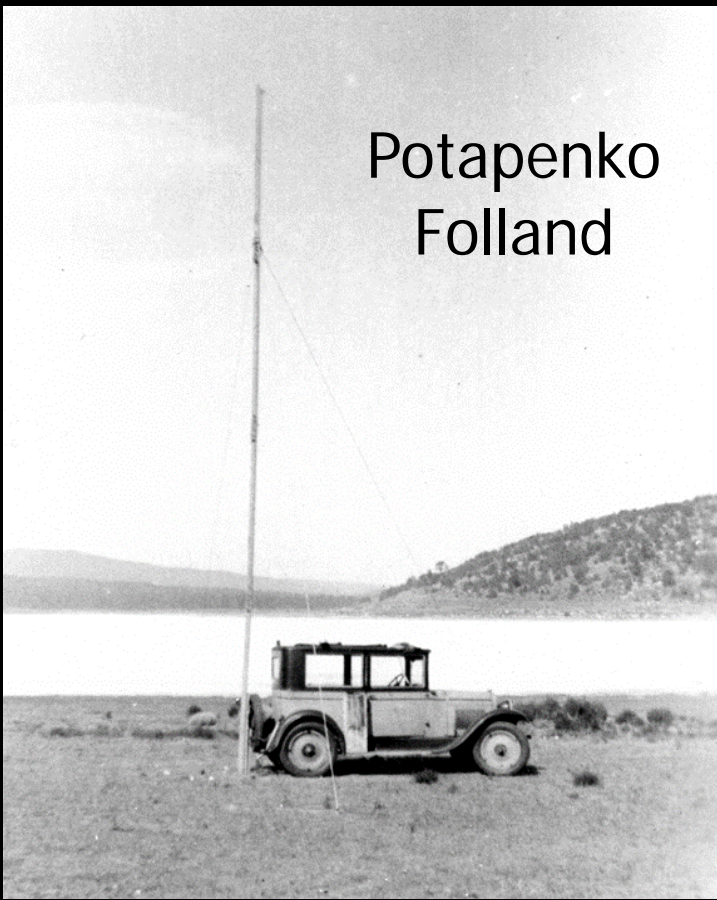
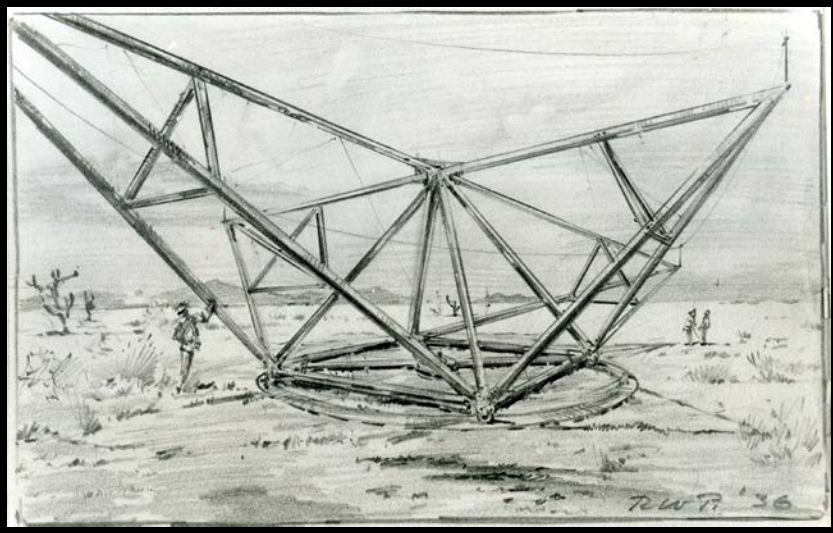
# After Star Noise



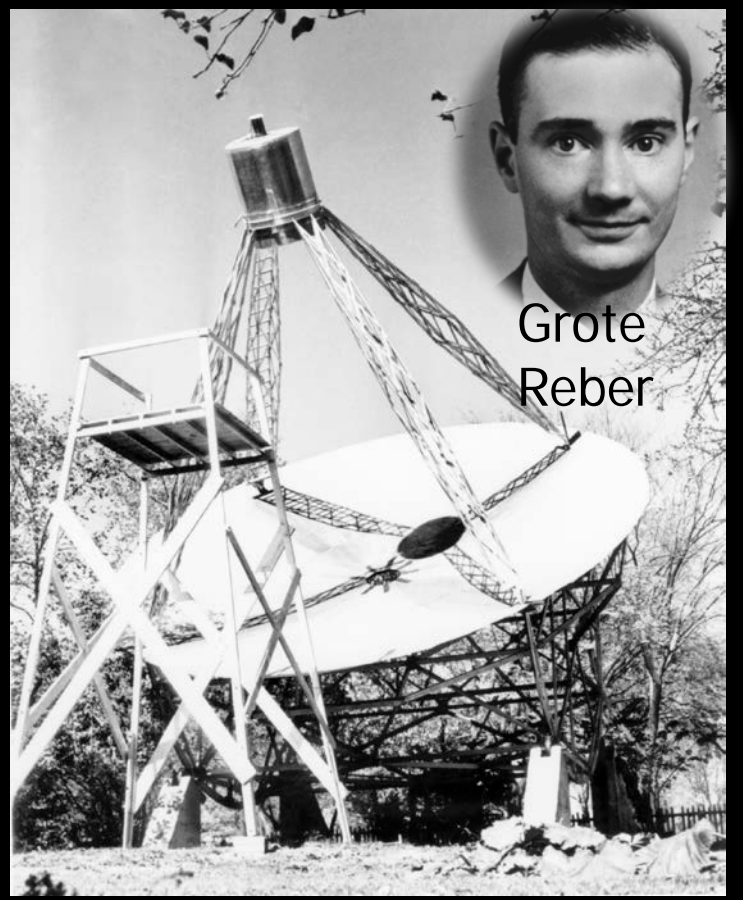
Fritz  
Zwicky



Gennady  
Potapenko



Potapenko  
Folland



Grote  
Reber

# The Controversy

- **John Pfiffer** (1956) *Rarely in the history of science has a pioneer stopped his work completely, at the very point where it was beginning to get exciting. Yet Jansky did just that.*
- **Frank Edmonson** (NSF) led to US "lagging far behind other countries ... in radio astronomy."
- **Moreau Jansky** "His superiors transferred [him] to other fields. He would have preferred to work in radio astronomy."
- **Friis** "Karl was free to work on star noise if he wanted to."  
No interest from astronomers
- **Alice Jansky** "How incredible, how preposterous, how positively unbelievable."
- **Karl's colleagues**: "he never expressed unhappiness in what he was doing." "he was assigned other duties." "treated unfairly, "cover – up," Friis was "dictator,"

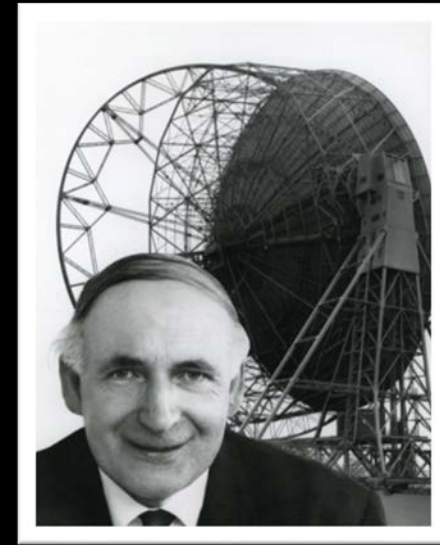
- US in depths of the great depression
  - ¼ people out of work.
  - Gallon of gas – 10 cents
  - Loaf of bread – 7 cents
  - *New York Times* – 2 cents
- March 4 - F. D. R. becomes US President – closed banks
- Adolf Hitler becomes German Chancellor – Jan 30 .
- Bell Labs in telephone, not astronomy, business –
  - 4 day work week
- Jansky turned down for job at University of Iowa
- Jansky increasingly involved in classified defense work
  - Short wave interference and propagation
  - Radio sextant
  - Submarine detection
- Transistor amplifiers - radio links - first transcontinental TV network

## The 1933 Scene



Army-Navy Award

# Remembering Karl Jansky?



"It cost Bell Labs a few thousand dollars. For them and for him [for us] it was a wonderful bargain."

*Jesse Greenstein. 8 June 1998*

"There can be few occasions when such observations have not only had such a profound consequence but also belong totally undisputed to one man – Karl Jansky"


*Sir Bernard Lovell, 8 June 1998*

# Nobel Prize Nomination

THE NOBEL PRIZE

Nobel Prizes & Laureates   Nomination   Alfred Nobel   News & insights   Events   Educational   Q

## Nomination archive




**Karl G Jansky**

Lastname/org:	Jansky
Firstname:	Karl
Initial:	G
Gender:	M
Year, Birth:	1905

**Nominee in 1 nomination:**

- [Physics 1948 by Winfried Schumann](#)





# Nobel Prizes in Astrophysics

- 1974 Martin Ryle and Tony Hewish - pioneering work in astrophysics
- 1978: Arno Penzias and Bob Wilson - detection of the cosmic microwave background
- 1998: Joe Taylor and Russell Hulse - discovery of the binary pulsar system
- 2006: John Mather and George Smoot – COBE CMB blackbody spectrum and anisotropy

# Karl Jansky's Legacy

The 1973 IAU General Assembly RESOLVED, that the name 'Jansky,' abbreviated 'Jy' be adopted as the unit of flux density in radio astronomy and that this unit, equal to  $10^{-26} \text{Wm}^{-2}\text{Hz}^{-1}$ , be incorporated into the international system of physical units.



NRAO Jansky Fellows

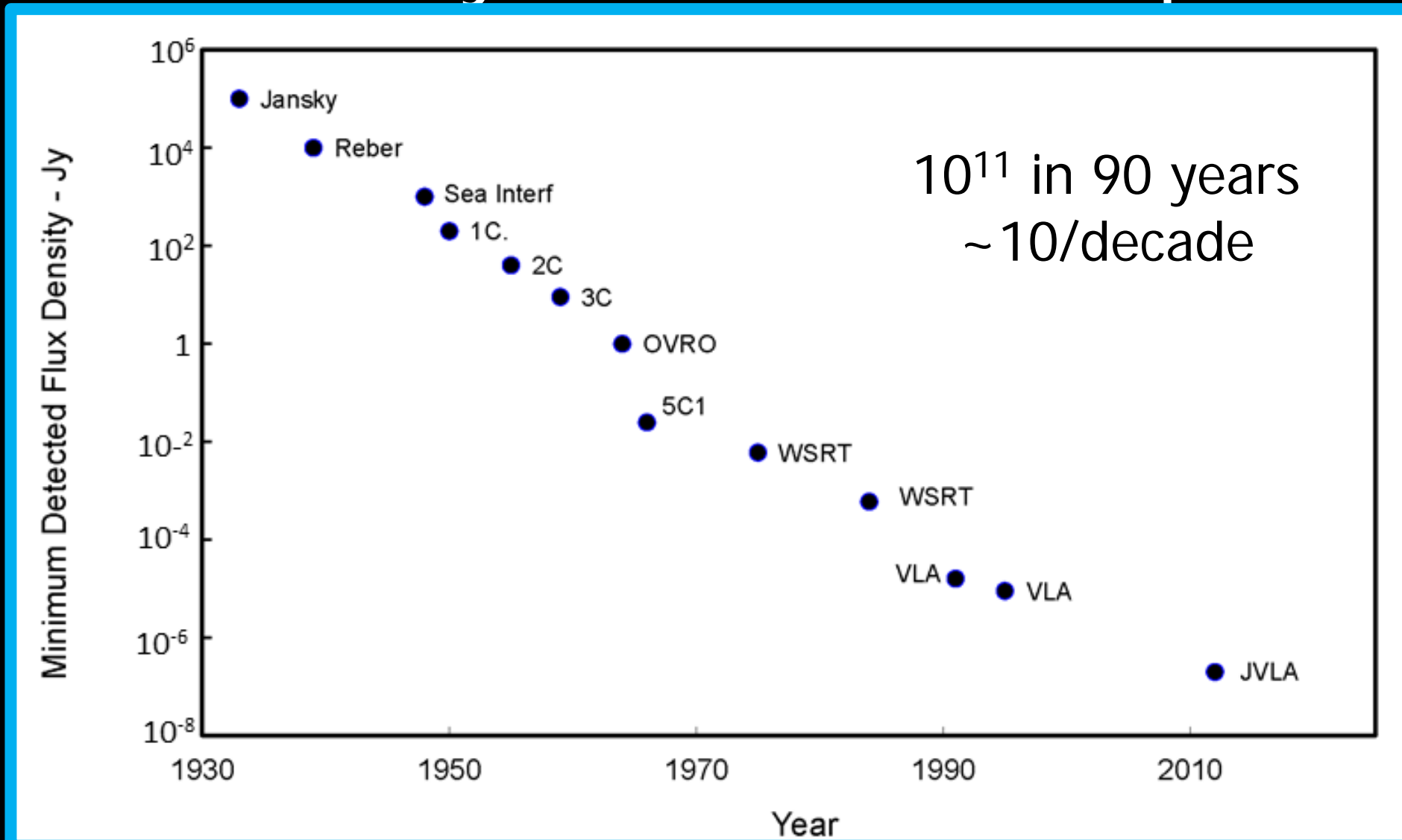


Karl Jansky

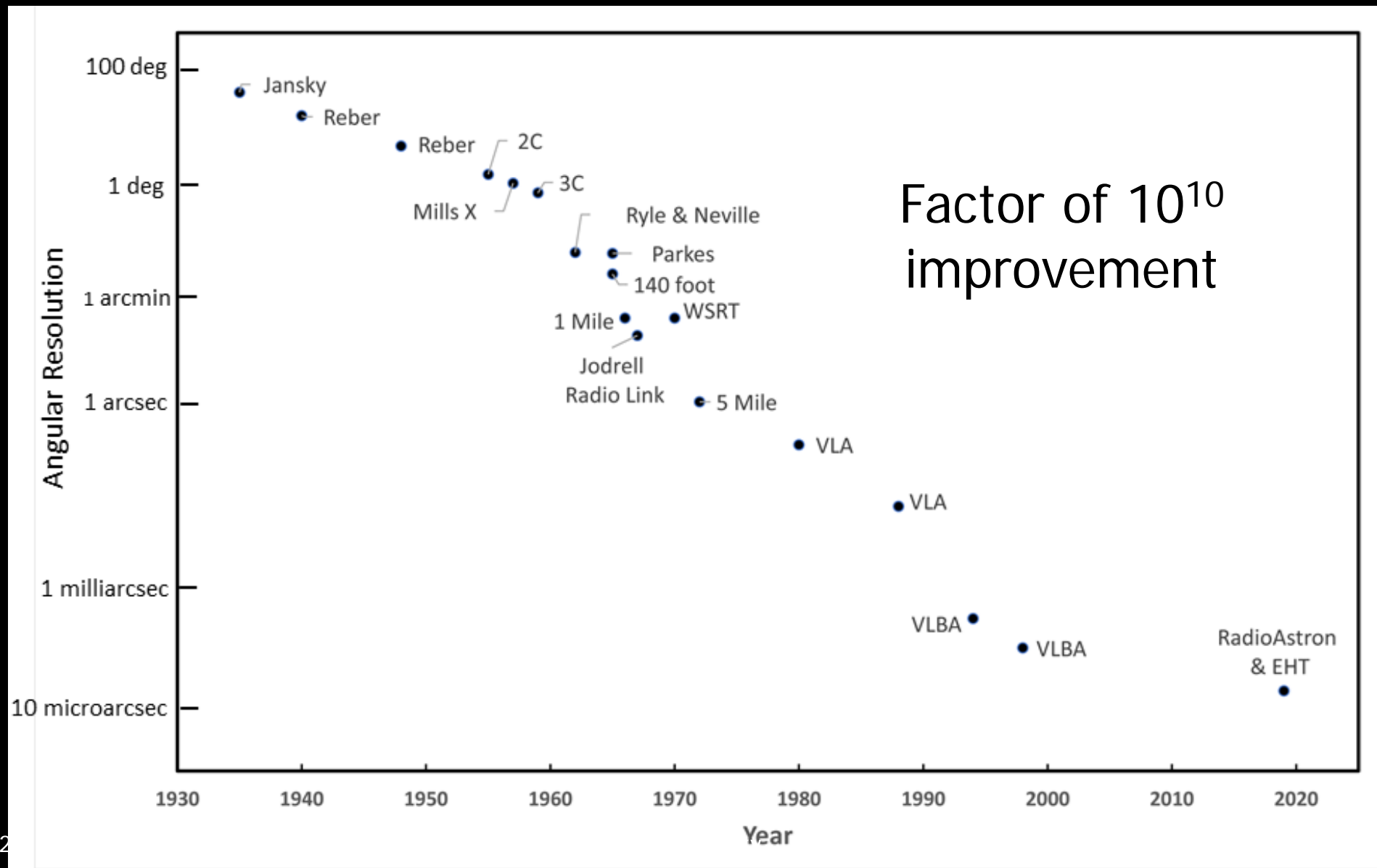


Karl Jansky Lectures

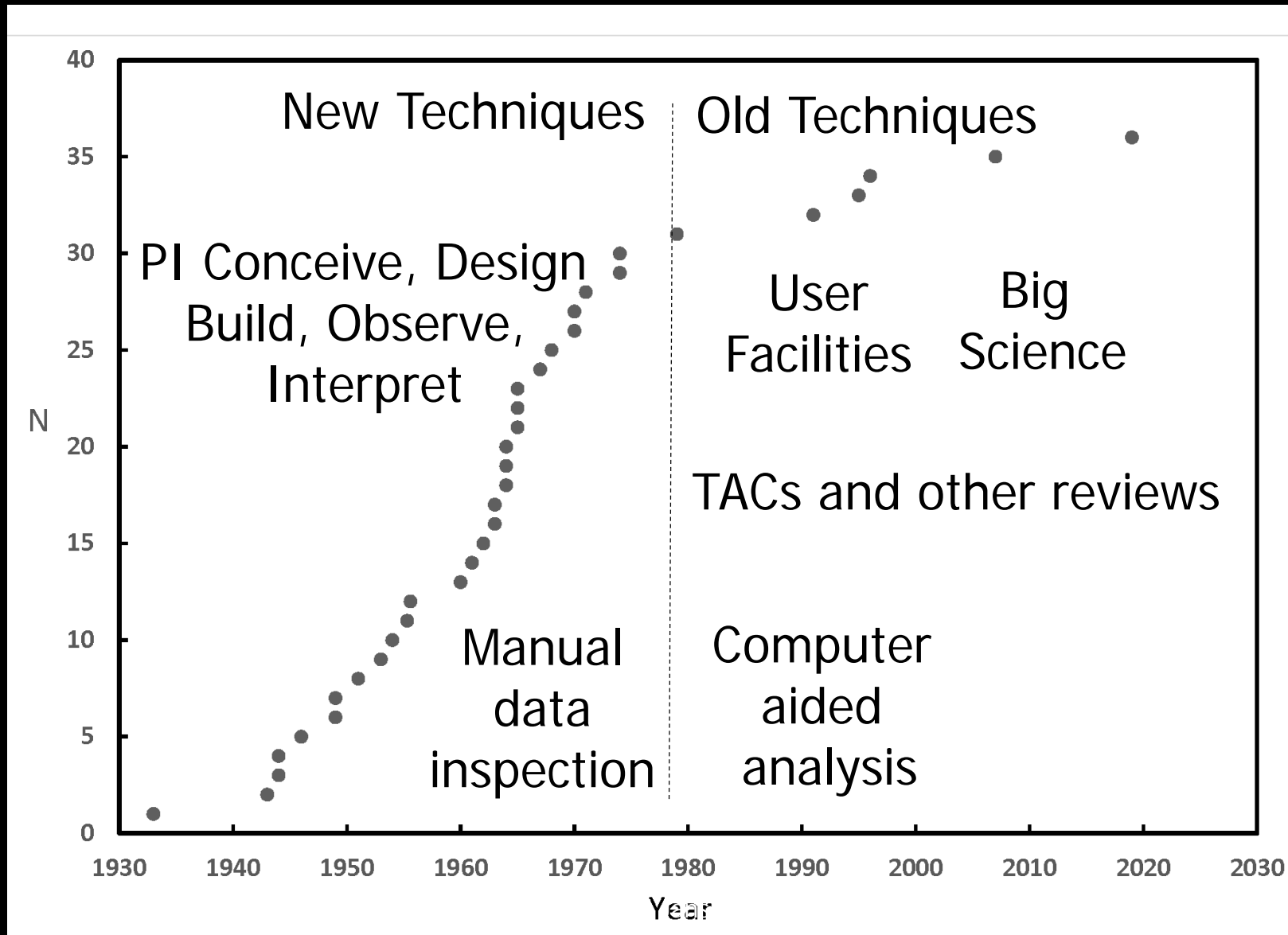
# Sensitivity of Radio Telescopes



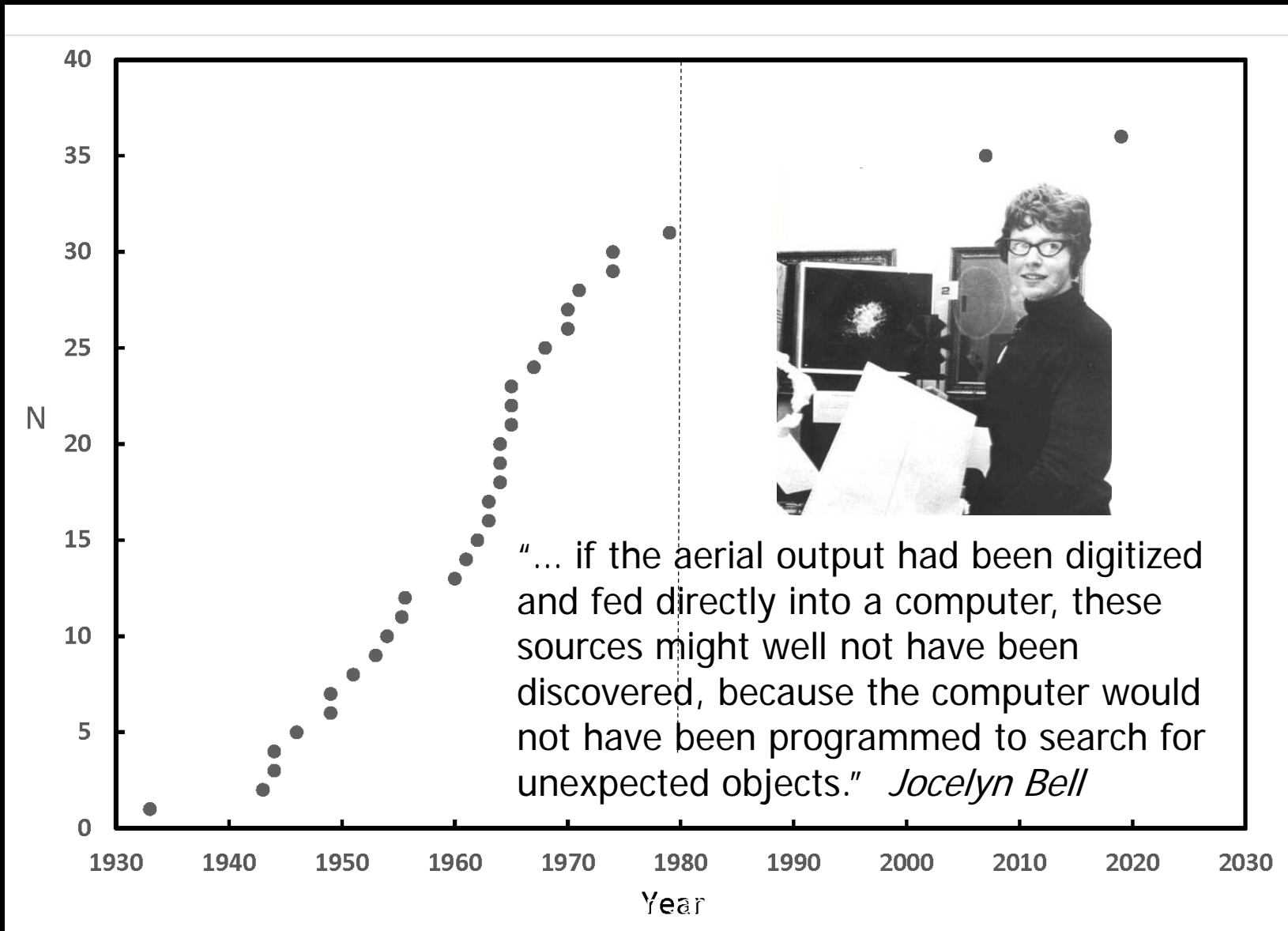
# Resolution of Radio Telescopes

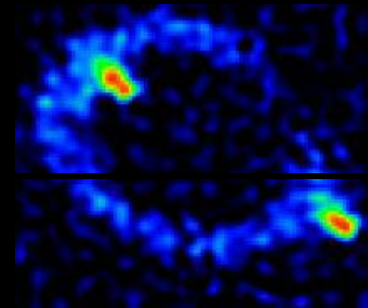
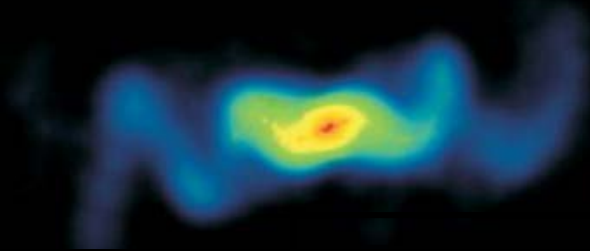
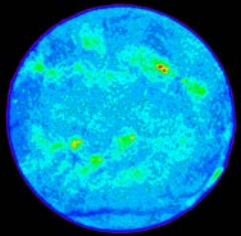


# Radio Astronomy Discoveries



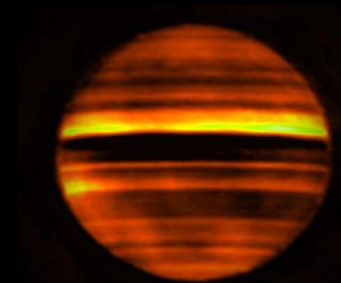
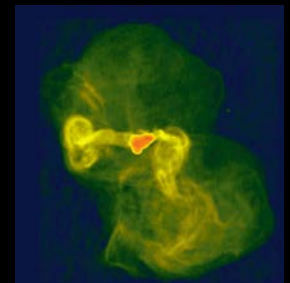
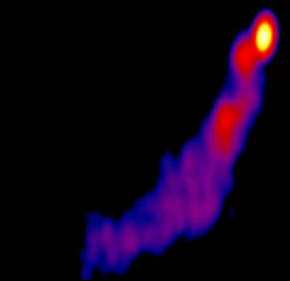
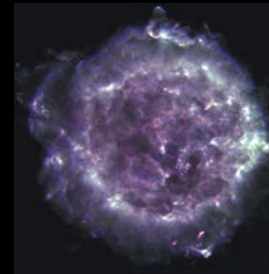
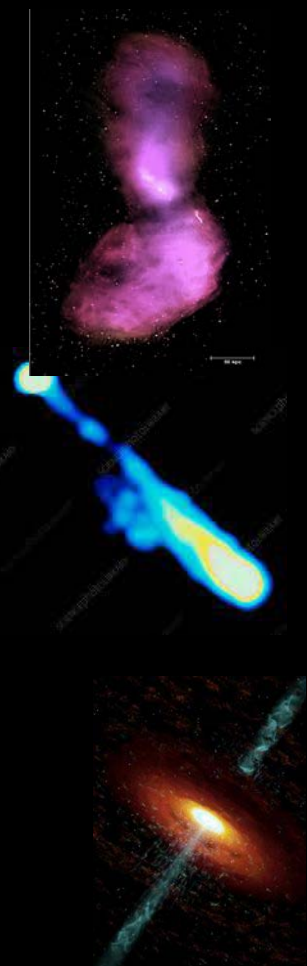
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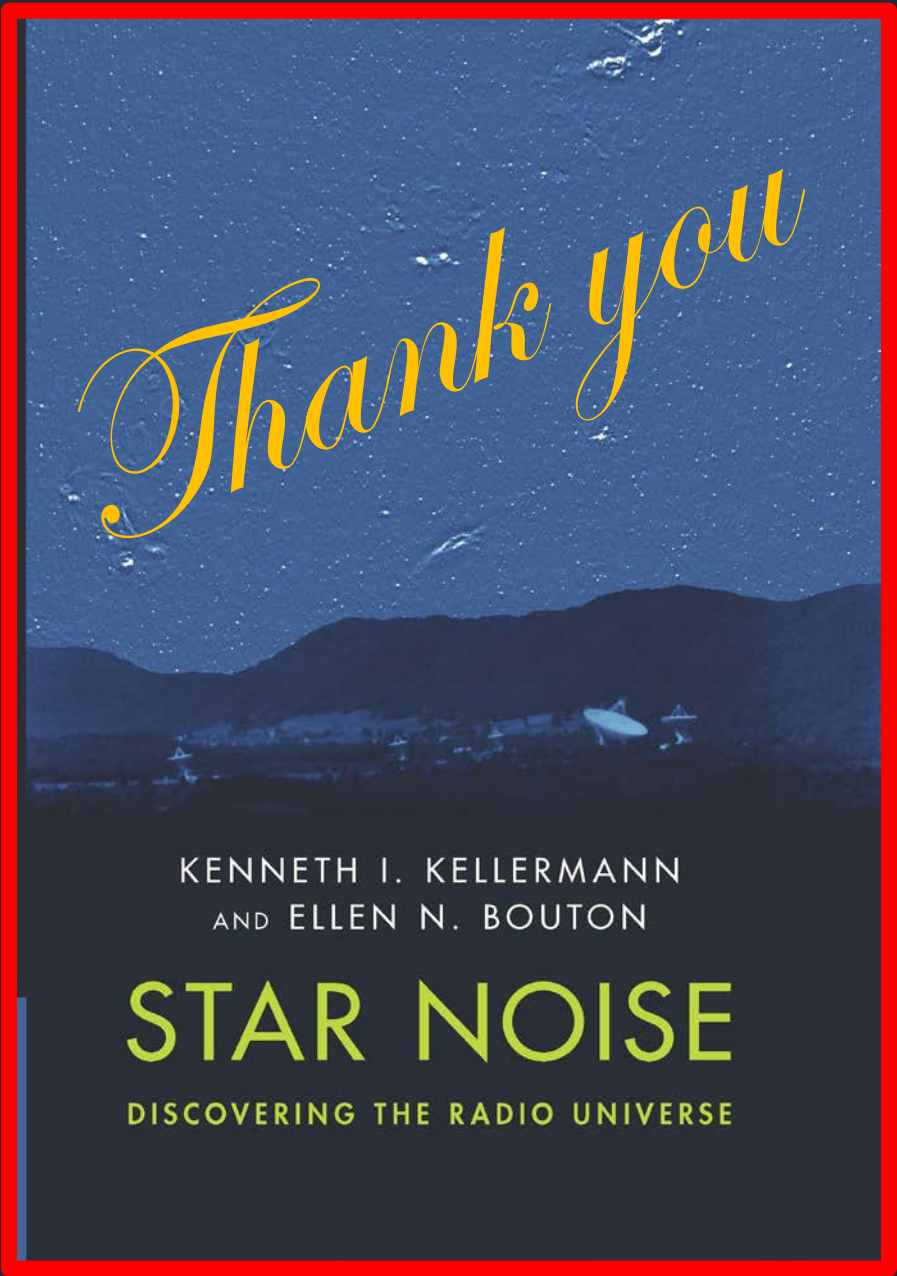




- Cosmic radio emission
- Solar radio bursts
- Solar corona
- Supernova remnants
- Radio Galaxies
- HI
- Electrical storms on Jupiter
- Cosmic evolution
- Jupiter van Allen Belts
- Rotation of Mercury
- Venus greenhouse effect
- Solar wind
- Radio Stars

- Quasars
- Radio Recombination Lines
- Pulsars
- Relativistic gravitational bending
- Cosmic Microwave Background
- Interstellar molecules
- Cosmic masers
- Superluminal motion
- Gravitational lensing
- Gravitational radiation
- First exoplanets
- Fast Radio Bursts





*Thank you*

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