

Contact

The Argus System in **Contact**

- How many telescopes?
- How many channels?
- Channel Width?
- Sensitivity?

ARGUS

131 telescopes pg. 63

Built by expanding the VLA

if similar antennas: $\frac{131}{27} \sim 5 \times$ the area

Coverage: 10^9 channels pg. 56, 62
channel width < 1 Hz pg. 56

$\Rightarrow \sim 10^9$ Hz if width = 1 Hz

Sensitivity: if assume better than VLA by 5,

5 Jy in 1 sec

$5 \times 10^{-26} \text{ W m}^{-2} \text{ Hz}^{-1}$

The Signal

- Frequency at which it was first detected?
- Bandwidth?
- Polarization?
- Other frequencies?
- Strength of the signal?

The Signal

First detected near 9 GHz pg. 66

$$\nu = 9.24176684$$

$$\Delta\nu = 430 \text{ Hz}$$



pg. 72

Linearly polarized

pg. 66

Later found at 1.420 GHz H pg. 78

1.667 GHz OH

Bimodal pulses 179 and 174 Jy pg. 72

Source of Signal

- How was terrestrial interference ruled out?
- How was it determined to come from Vega?
- How do we know it was intended for us?
 - Rather than omnidirectional
 - BEFORE the message decoded

The Signal

Not Terrestrial:

Moving Sidereally pg. 66

Vega:

Interferometric Position pg. 65

Proper Motion pg. 78

Doppler Corrected pg. 78

What were the 4 Levels of information?

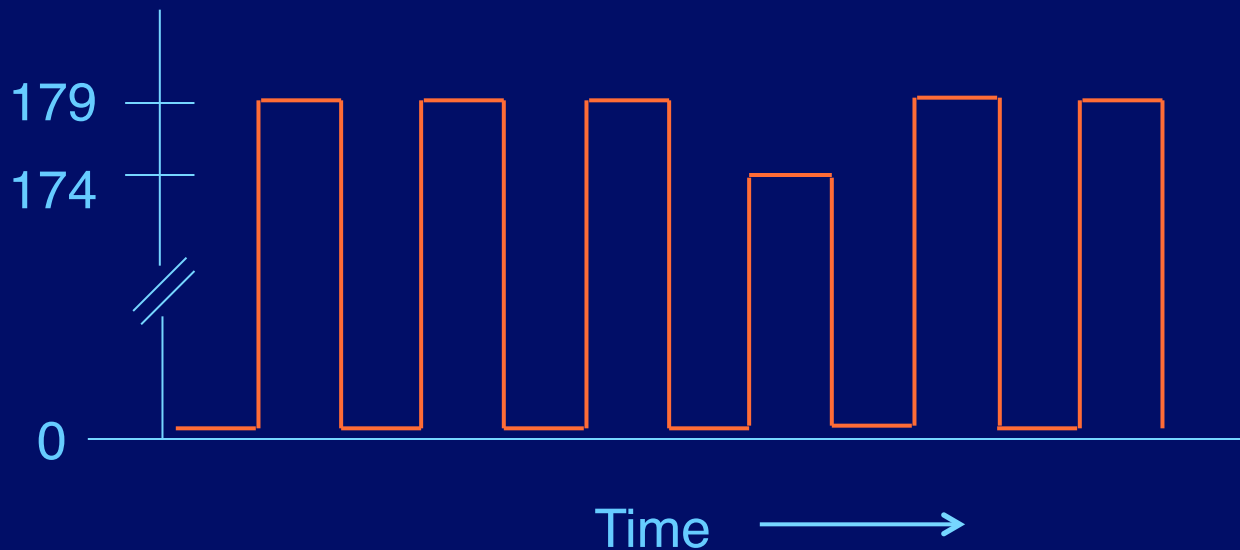
- How encoded (modulation method)?
- What was the purpose of each?

The Prime Numbers

Amplitude Modulation

- (“Strength is the Message”)

Bimodal amplitudes 174 & 179 Jy



Convention

179 = 1

174 = 0

1 1 1 0 1 1

$2^5 + 2^4 + 2^3 + 0 + 2^1 + 1$

$32 + 16 + 8 + 0 + 2 + 1 = 59$ (pg. 68)

The Movie (and the Instructions)

Polarization Modulation

(pg. 83)

- (“Direction is the Message”)



Decoding the Movie

- Repeating pattern
- Tens of billions of bits
- Product of 3 prime numbers
- Guess 2D image and time, so movie
- Purpose?

Machine Instructions

- Palimpsest (pg. 100)
- Under the movie (pg. 185)
- Polarization modulation
- Purpose: They know about us...

Suggestions for the Primer

- Sol Hadden made 5 suggestions for finding it
- What were they?
- Which was right?

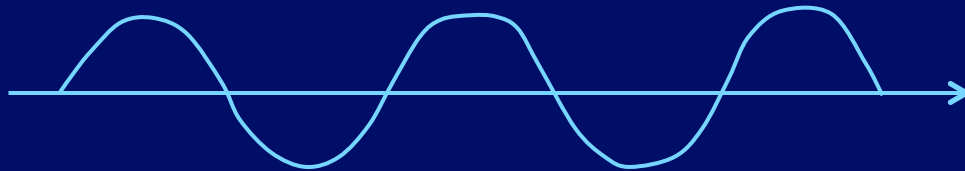
Five Suggestions (pg. 220)

- Slower bit rate (e.g., 1 bit per hour)
- Faster bit rates (would require more BW)
- Occasional fast data dump
- Phase modulation
- Have to detect from space
 - e.g., around 5 mm, where O₂ blocks waves

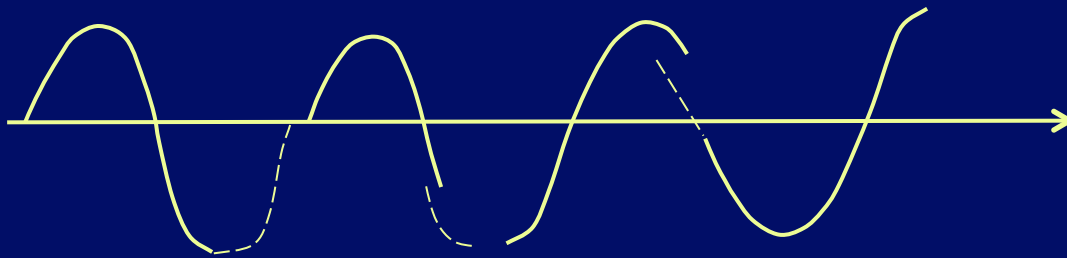
The Primer

Phase Modulation

- (“Timing is the Message”)



Steadily
Increasing
Phase



Rapid Changes
in Phase

How The Primer Works

1 A 1 B 2 Z 1 + 1 = 2 TRUE

1 A 2 B 3 Z 1 + 2 = 3 TRUE

1 A 2 B 4 Y 1 + 2 = 4 FALSE

⇒ A is +

 B is =

 Z is TRUE

 Y is FALSE