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: $\dfrac{131}{27}$ ~ 5 × the area

   Coverage: 10^9 channels   pg. 56, 62

     channel width < 1 Hz   pg. 56

   ⇒ ~ 10^9 Hz if width = 1 Hz

   Sensitivity: if assume better than VLA by 5,

   5 Jy in 1 sec

   5×10^{-26} W m^{-2} Hz^{-1}

The Signal

- Frequency at which it was first detected?
- Bandwidth?
- Polarization?
- Other frequencies?

The Signal

First detected near 9 GHz   pg. 66

$\nu = 9.24176684$ pg. 72

$\Delta\nu = 430$ Hz

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

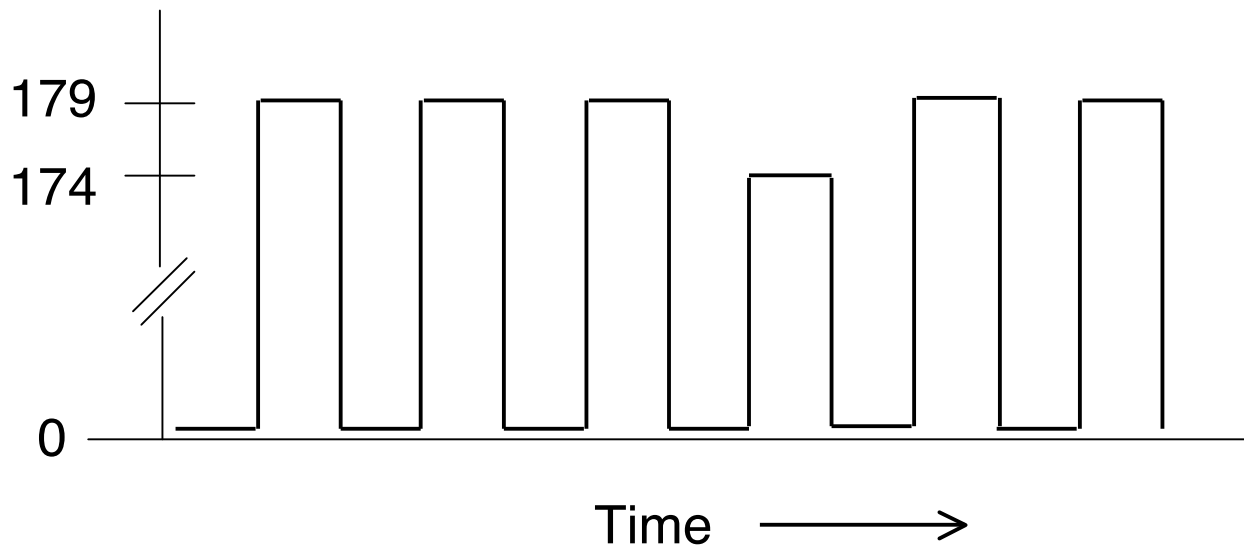Doppler Corrected   pg. 78

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

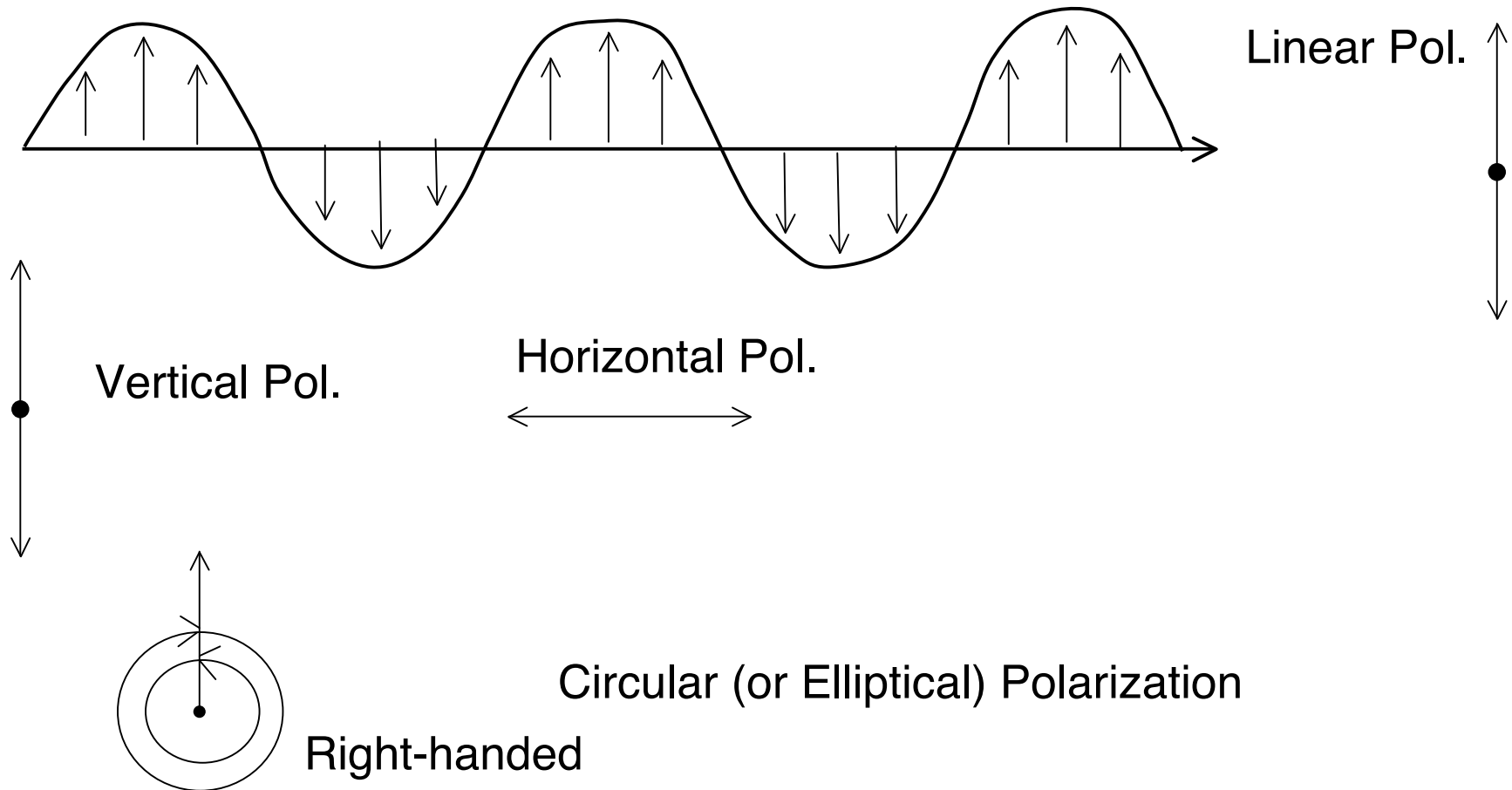$$2^5 + 2^4 + 2^3 + 0 + 2^1 + 1$$

$$32 + 16 + 8 + 0 + 2 + 1 = 59 \qquad \text{(pg. 68)}$$

The Movie (and the Instructions)

Polarization Modulation   (pg. 83)

  - ("Direction is the Message")

Linear Pol.

Vertical Pol.

Horizontal Pol.

Circular (or Elliptical) Polarization

Right-handed

Decoding the Movie

- Repeating pattern
- Tens of billions of bits
- Product of 3 prime numbers
- Guess 2D image and time, so movie
- Purpose?
  – They know about us…

Machine Instructions

- Palimpsest   (pg. 100)
- Under the movie (pg. 185)
- Polarization modulation
- Purpose:

Suggestions for the Primer

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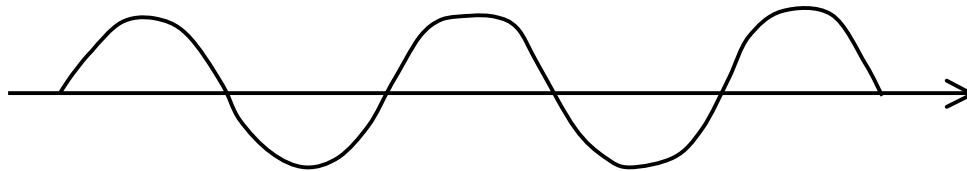- What were they?
- Which was right?

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
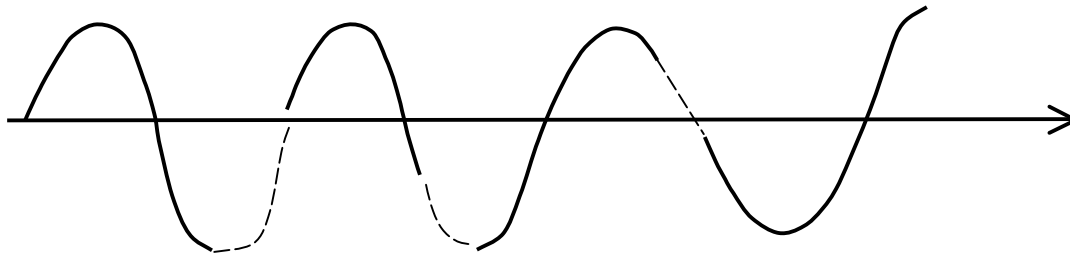 - e.g., around 5 mm, where O_2 blocks waves

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

$\Rightarrow$ A   is +

       B   is =

       Z   is   TRUE

       Y   is   FALSE