

# **Radio and Space Telescopes**

The background of the slide features several thick, light gray, wavy lines that flow from the bottom right towards the center, creating a sense of movement and depth.

# Strange Static

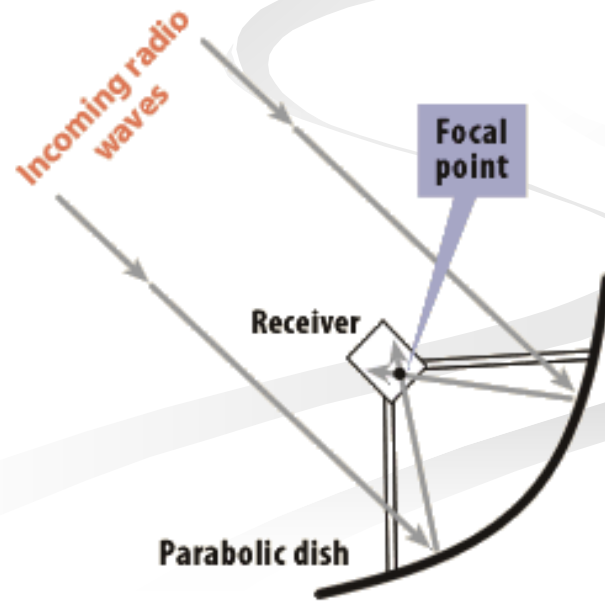
- In the 1930's, Bell Telephone Laboratories experimented with using radio waves to make phone calls across the ocean
- The company quickly encountered a problem: a strange hissing noise that would interfere with the transmissions
- Karl Jansky was assigned the task of figuring out the source of the static
- He built a set of wire rectangles that served as antennas
- He realized that the static was coming from the center of the Milky Way
- This discovery launched the new field of radio astronomy

# Radio Telescopes

- Radio telescopes use dishes to collect radio waves
- The dishes are the same shapes as the mirrors in reflecting telescopes
- Radio waves bounce off the dish and meet at a single point called the focal point, where a receiver is positioned



Courtesy NRAO  
The Very Large Array  
in New Mexico



# Radio Astronomy

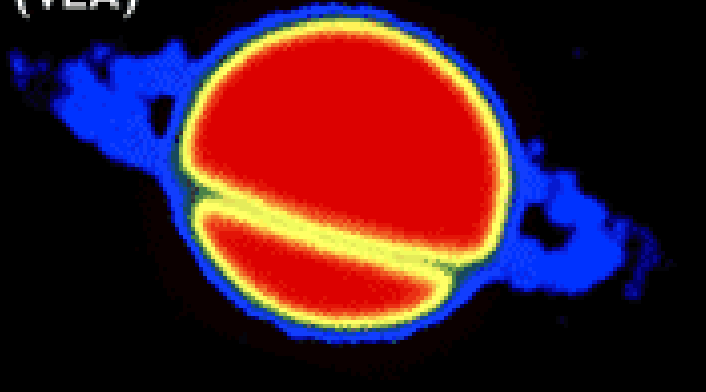
- Radio astronomers can look for radio sources during the day
- Radio astronomy can be performed in any type of weather because radio waves pass through clouds as if they weren't there
- Because radio wavelengths are so long, they reach the ground undistorted by the atmosphere

# Seeing the Invisible

Saturn in visible wavelengths  
(HST)



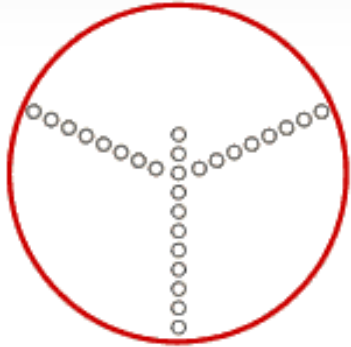
Saturn in radio wavelengths  
(VLA)



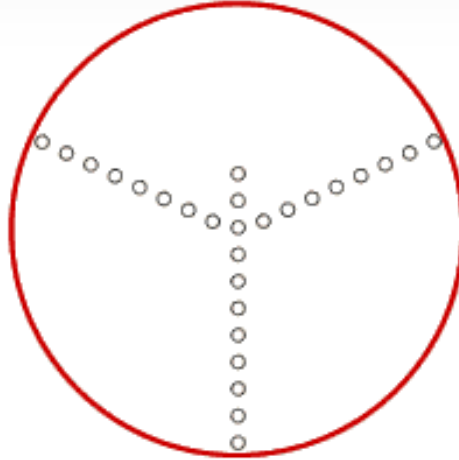
- Many celestial objects, including some planets, comets, giant clouds of gas and dust, pulsars, and black holes, emit radio waves
- Radio waves can give information about the composition, structure, and motion of these astronomical objects
- Scientists have also developed sophisticated systems that create images from these radio signals in order to “see” the objects in the radio light they emit.

# Arrays

Arranged as shown below (gray circles), the 27 dishes have the resolution of a single dish as big as the red circle:



Spaced slightly farther apart, the 27 dishes have the resolution of a dish as large as this red circle:



- To get a clear picture, radio telescopes have to be huge, because radio waves are so large
  - A dish 64 meters wide produces an image that is about as detailed as a visible-light image from a small backyard telescope
- To create clearer, higher-resolution radio images, several smaller telescopes or dishes are often combined to form an array
  - Together, the dishes act like a single telescope as large as the diameter of the array.

# Very Large Array

- The Very Large Array (VLA) in New Mexico has 27 individual radio dishes laid out in a Y shape. The dishes can be moved closer together or farther apart to achieve different resolutions. When they are at their farthest apart, the array has a resolution equal to a single dish that is 22 miles (36 km) in diameter



# Computers

- Computers make radio arrays possible
- Computers process the signals from the many dishes and combine them into one signal
- The technique of combining the signals from several telescopes is called interferometry