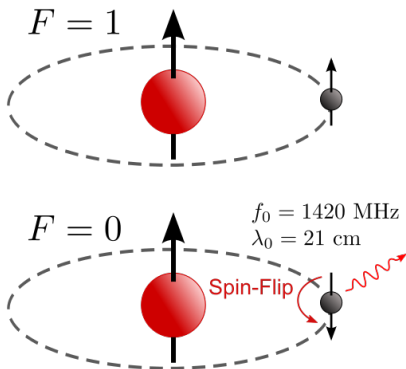


# Determining Galactic Structure through 21cm Emission Lines

Henry Shackleton

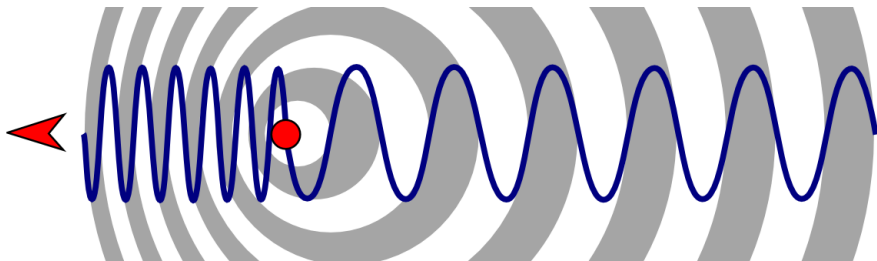
May 9, 2017

# Hyperfine Structure of Hydrogen Emits 21cm Wavelength Emission



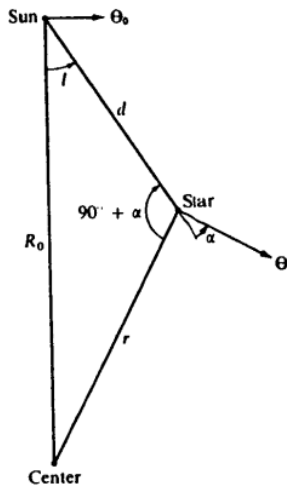
- Hydrogen electron spin-flip causes electromagnetic radiation at a frequency of 1420.41 MHz.
- Low probability ( $2.9 \times 10^{-15} \text{ s}^{-1}$ ), but the vast amount of hydrogen in the galaxy allows for this detection

# Doppler Shift Gives Change in 21cm Line Proportional to Velocity



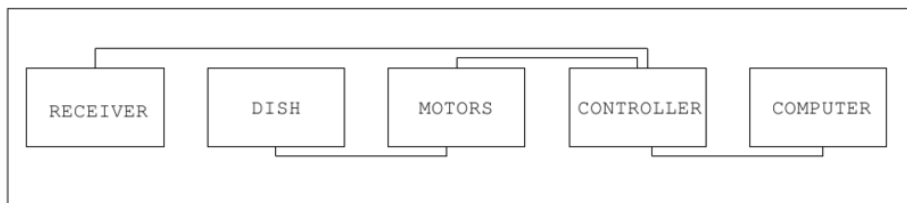
$$v = c \frac{1420.41 - \nu}{\nu}$$

# Location of Hydrogen Masses Determined through Geometry



- Velocity we observe is the velocity of the mass *projected* onto our line of sight.
- $v_{obs} = \frac{\Theta}{r} R_0 \sin \ell - \Theta_0 \sin \ell$
- Relation between  $\Theta$  and  $r$  obtained through Galactic Rotation Curve.

# SRT Measures Radio Power Within Given Frequency Domain



- Noise diode allows for calibration of telescope.
- Receiver selects desired bandwidth for data collection.