11.15: Stellar and Celestial Object Brightness

There are a number of other stellar characteristics astronomers and astrophysicists consider. **Luminosity** is a star's total amount of power radiated into space, measured in watts. Think about a light bulb in your home. The output is measured in watts. Most of us use 60 watts tungsten light bulbs or the new LED bulbs with an output of around 60 watts, yet using about 10 watts of power.

How does a light bulb with a luminosity of 60 watts compare to the Sun's output? The accepted luminosity of the Sun is 3.846×10^{26} watts. With such large numbers, the Sun's luminosity is often stated as $1\ L_{\odot}$. The number $1\ L_{\odot}$ is easier to work with than 3.846×10^{26} watts, yet they mean the same quantity.

Apparent Brightness is the amount of light reaching us per unit area, measured in flux. This incoming light varies by the **Inverse Square Law**. Mathematically this is given as:

Apparent Brightness is proportional to $1/d^2$

Let's look at an example many have experienced. You see a light one mile away, and note its brightness. You move away from the light, and you again look at the light. You might think the light should be half as bright. Actually it is ¼ as bright, as given by the Inverse Square Law.

Apparent brightness at 1 mile: $1/1^2 = 1$ Apparent brightness at 2 miles: $1/2^2 = ¼$

We all experience the Inverse Square Law in real life, from driving a car at night to looking at lights on and in buildings and streetlights as we approach a light or move away from the light.