

# ASTR 1020

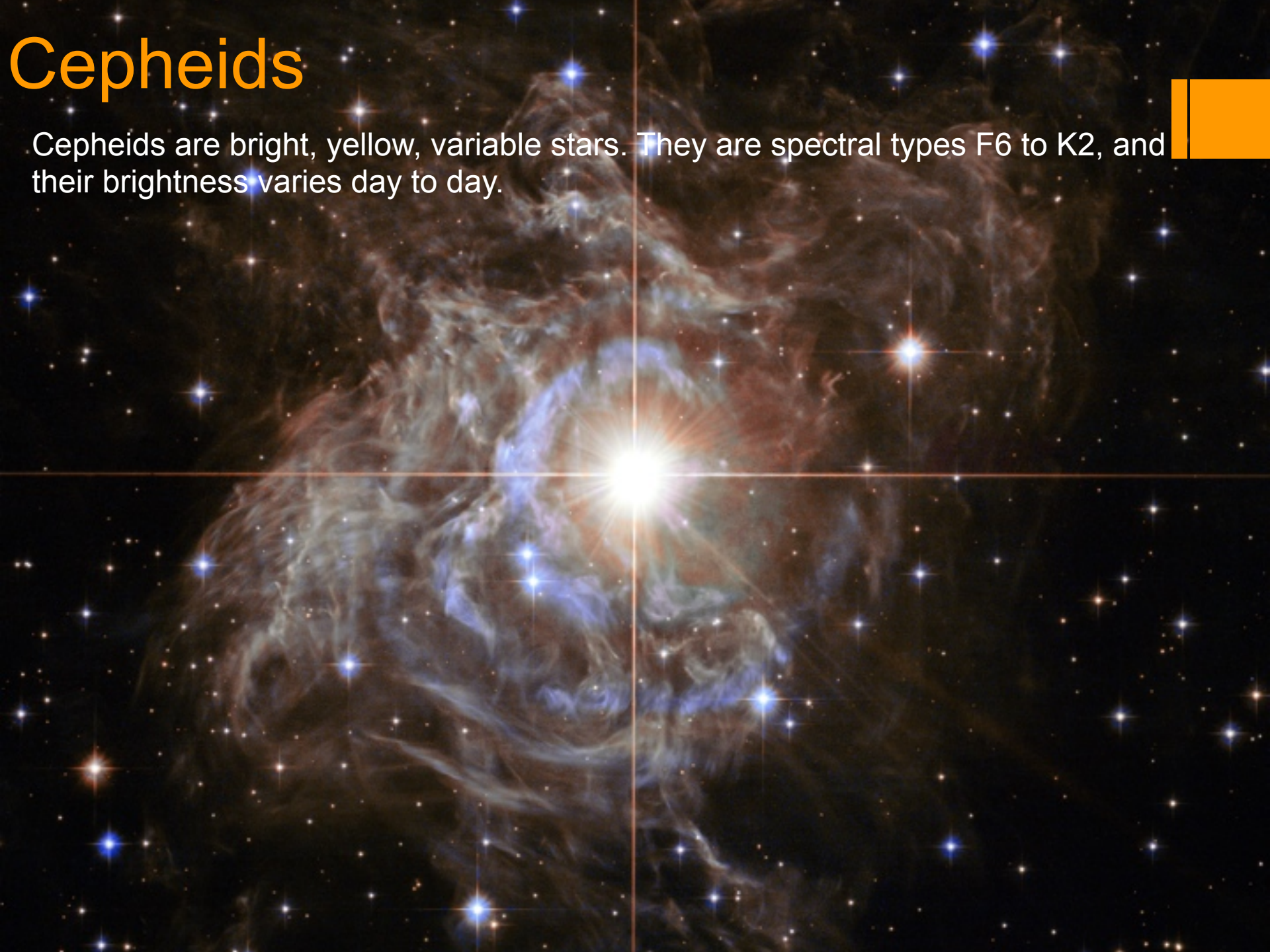
## Lab 14: The Period-Luminosity Relationship





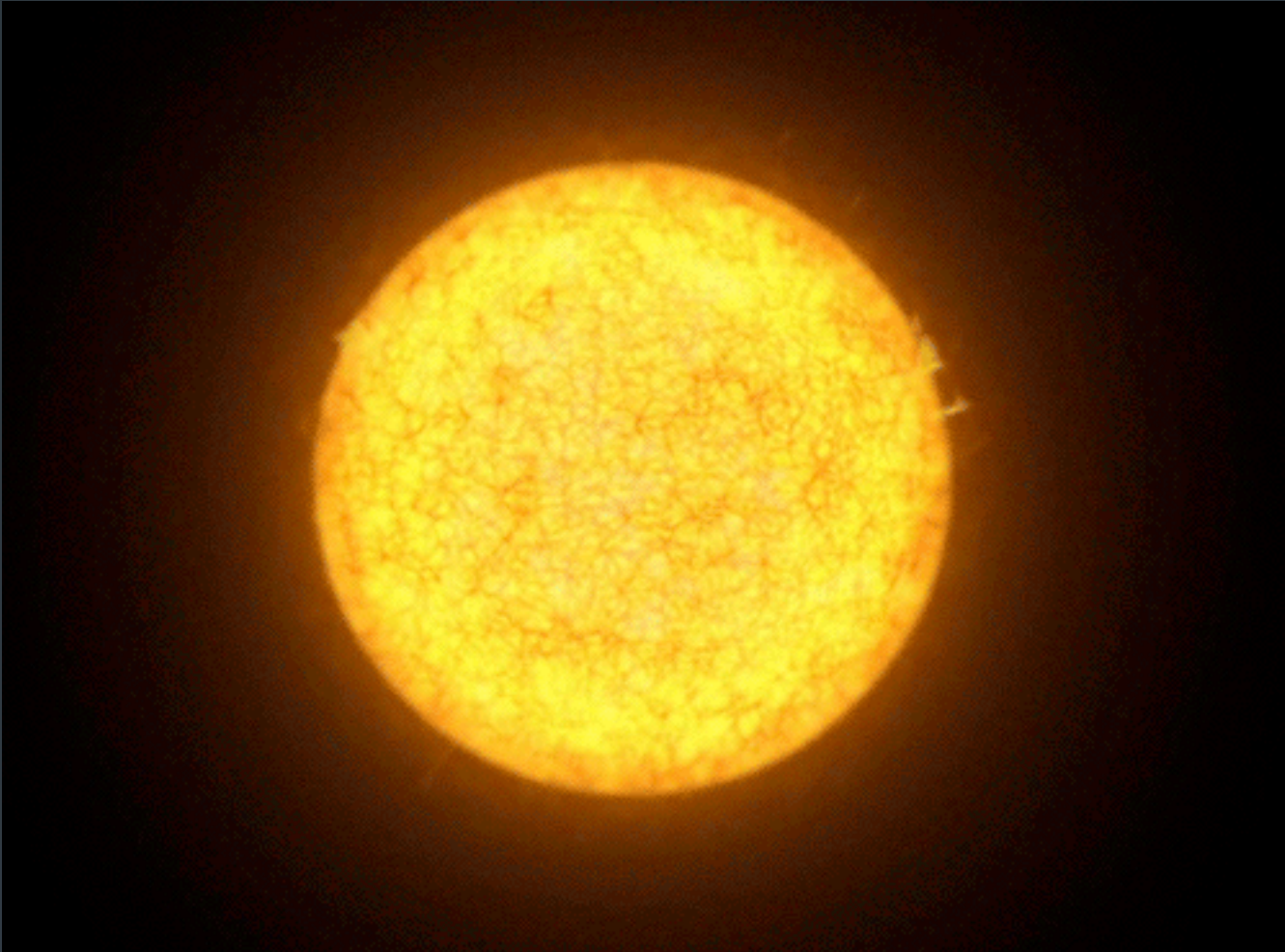
# Cepheids

Cepheids are bright, yellow, variable stars. They are spectral types F6 to K2, and their brightness varies day to day.



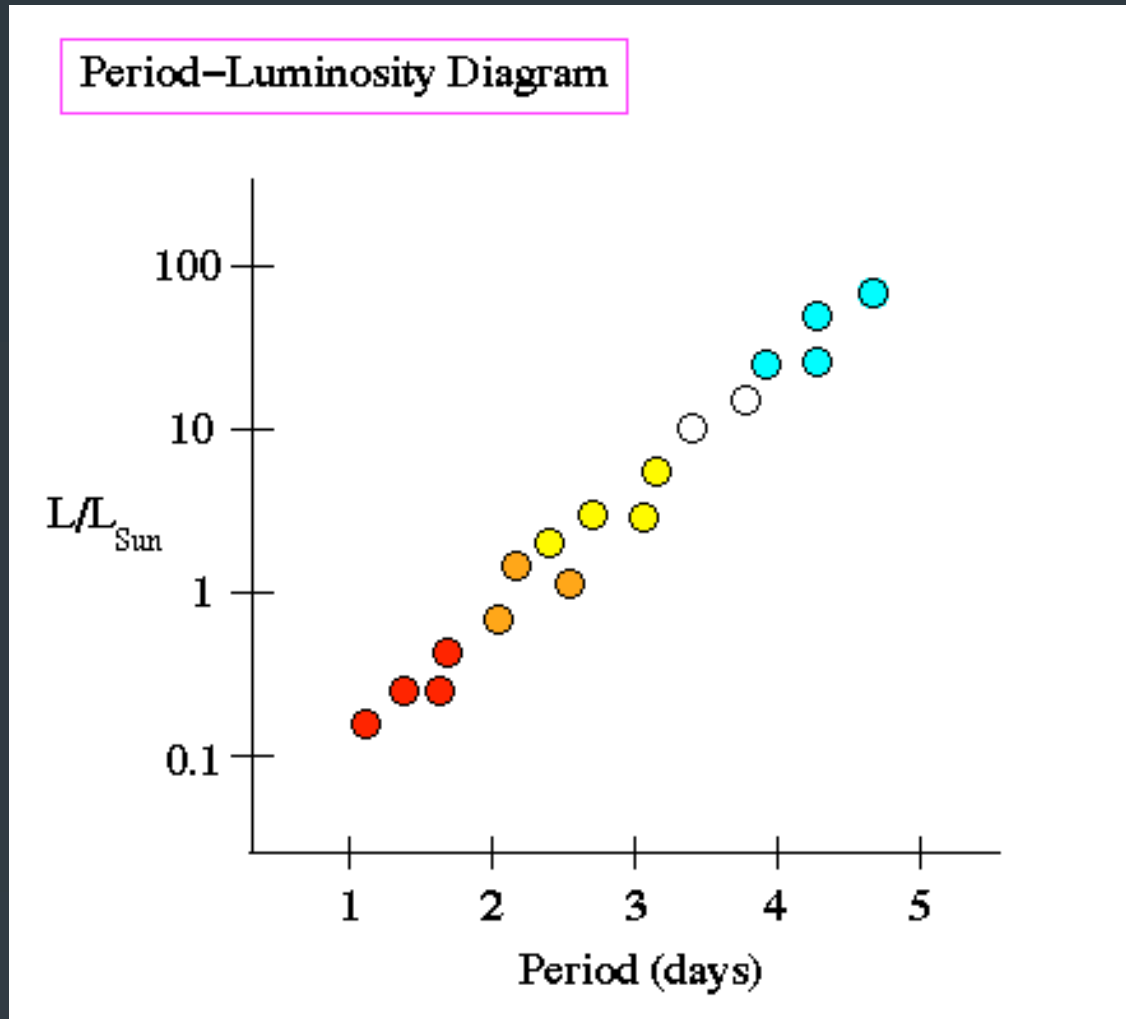
# Cepheids

Cepheid variable star brightness changes in predictable ways. The stars rhythmically contract and expand over a course of several days or months. Cepheid stars with longer periods are on average brighter.



# Luminosity-Period Relation

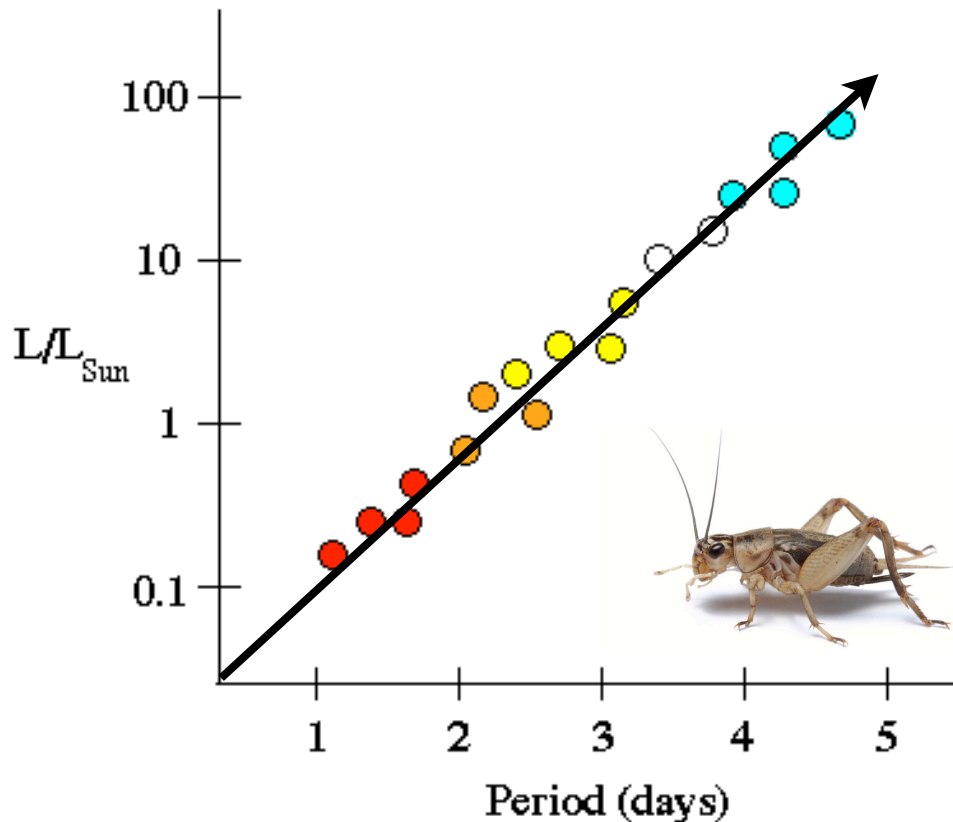
We can make a plot of brightness vs. period. As you can see, brightness goes up as brightness-cycle period goes up. Luminosity  $L$ , like absolute magnitude  $M_v$ , is a measure of the intrinsic brightness of a star.



# Luminosity-Period Relation

Therefore, from the period (easy to observe), you can calculate the intrinsic brightness of the star. It's just like figuring out the air temperature based on how often a cricket chirps--Did you know you can do that?

Period-Luminosity Diagram



Temperature  
in  $^{\circ}\text{F} = \#$  of  
cricket chirps  
in 15 s + 37



# Distance Modulus

Remember, a light looks brighter close-up and dimmer far away. Thus, if we know how bright a source looks from some known distance (absolute magnitude  $M$ ) compared to how bright it looks from here on earth (apparent magnitude  $m$ ), we can figure out how far away (distance  $d$ ) the source is.

**Distance modulus:**

$$m - M$$

**Distance in parsecs:**

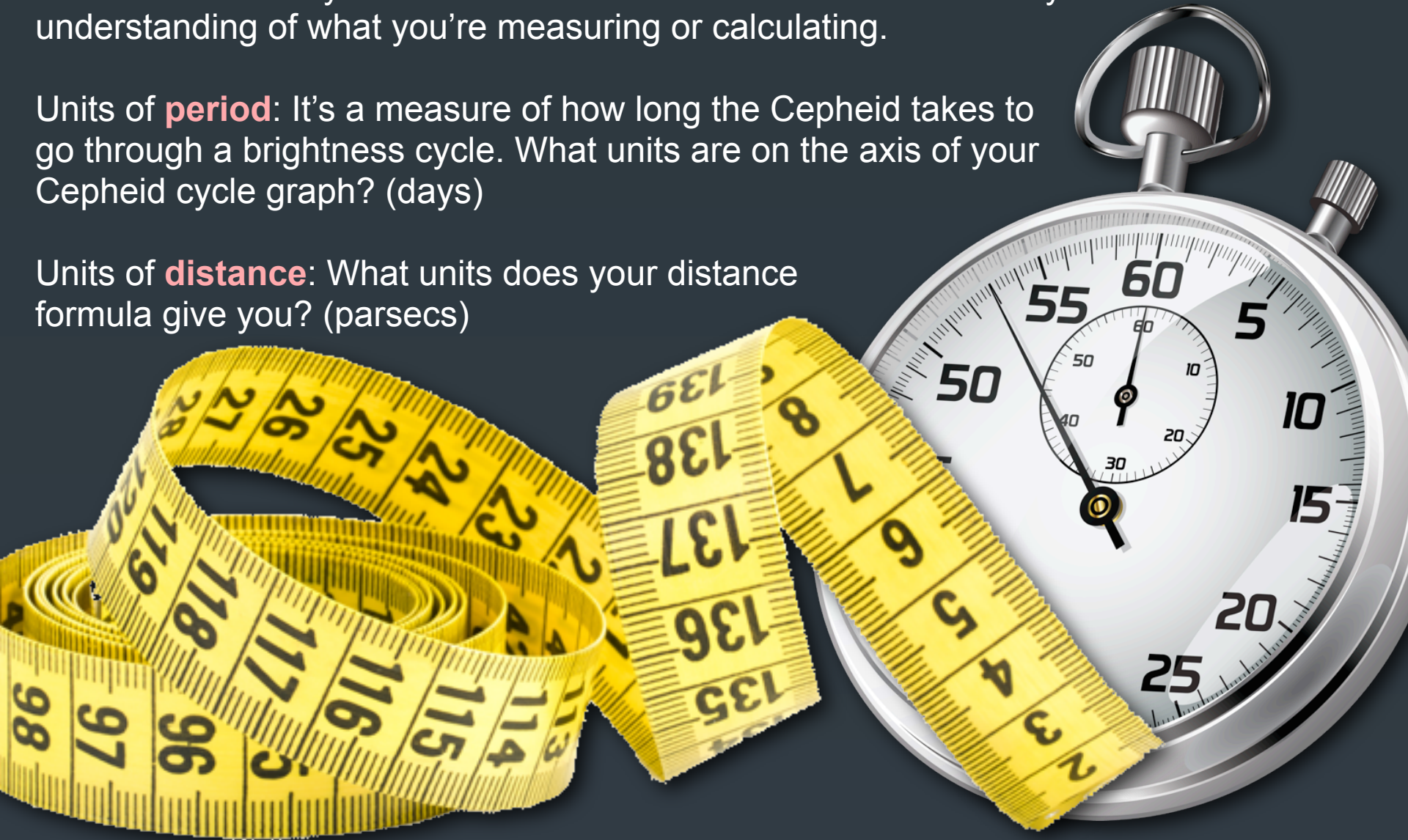
$$d = 10 * 10^{(m - M) / 5}$$

# Units Matter!

A measurement without units is meaningless. 10. 10 what? 10 km? 10 years? 10 bananas? Include your units! It informs the reader AND confirms your understanding of what you're measuring or calculating.

Units of **period**: It's a measure of how long the Cepheid takes to go through a brightness cycle. What units are on the axis of your Cepheid cycle graph? (days)

Units of **distance**: What units does your distance formula give you? (parsecs)





# Distances from Cepheid Data

We'll use all this information on cepheids to figure out the distance to a nearby galaxy.





Fin

