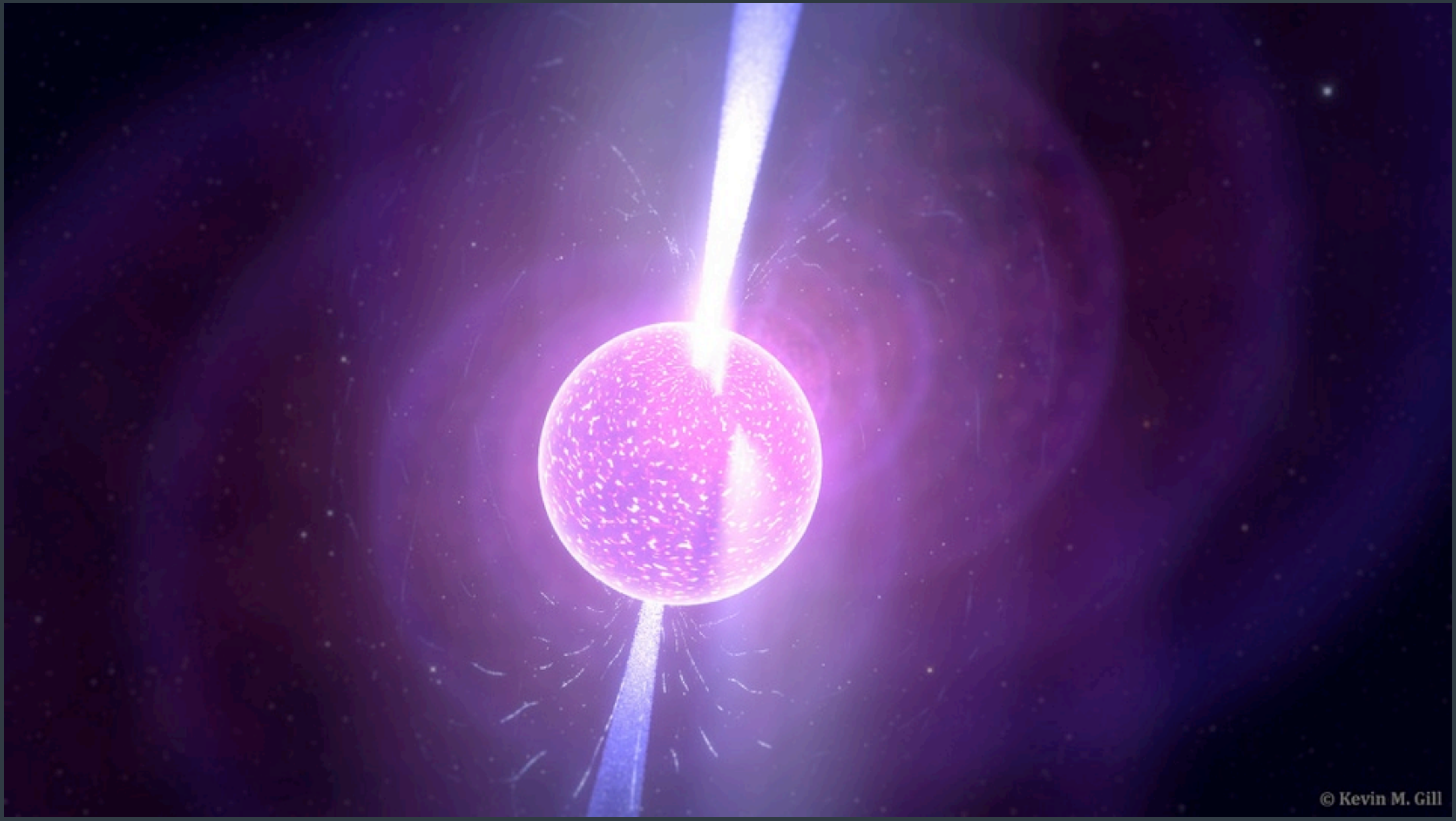
ASTR 1020

Lab CLEA: Radio Astronomy of Pulsars

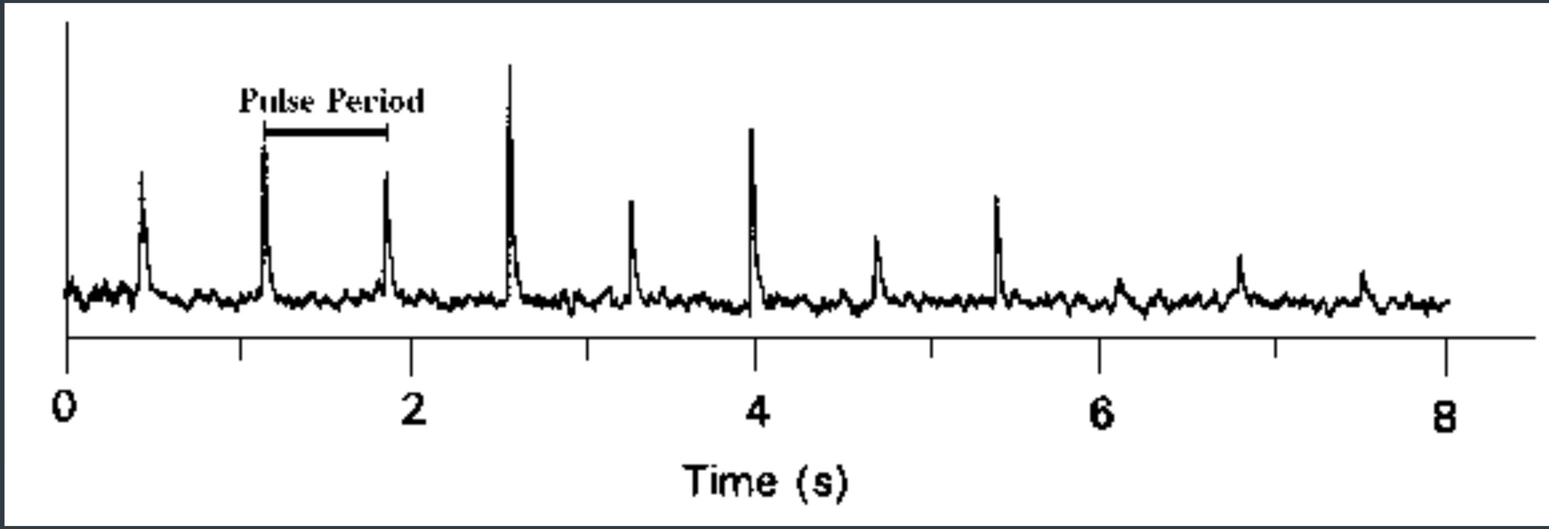
Neutron Stars

When a star 4 - 8 times more massive than the sun collapses, it becomes a neutron star. This is an EXTREMELY dense object that spins very fast and has radiation streaming out of its magnetic poles.



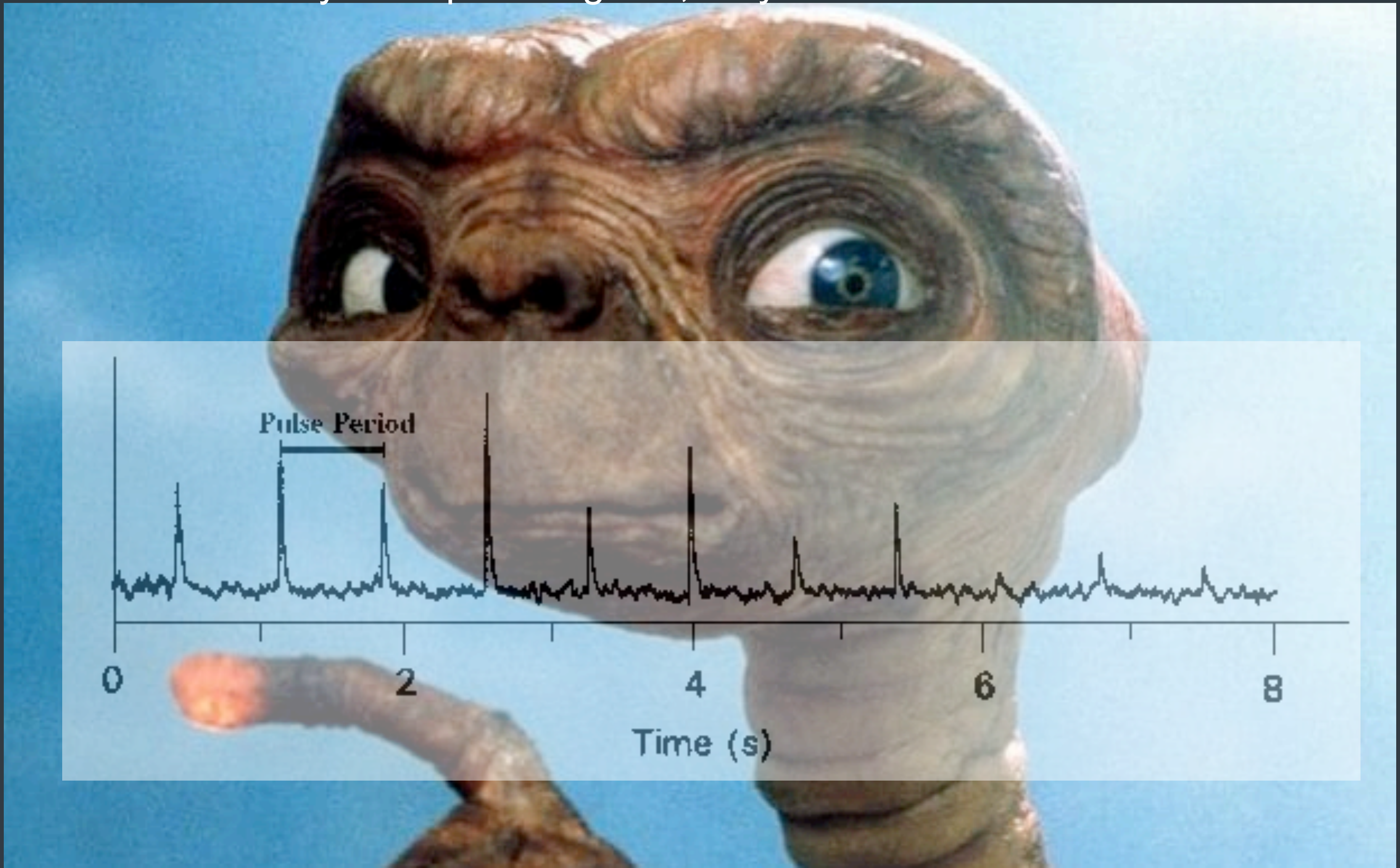
Signals from Space

We can measure the light streaming out of a neutron star's poles, particularly in the radio wavelengths (yes, radio waves are actually a very low-energy form of light! You can't see it with your eyes). The first time Jocelyn Bell and Antony Hewish saw these rhythmic pulse signals, they weren't sure of the source.



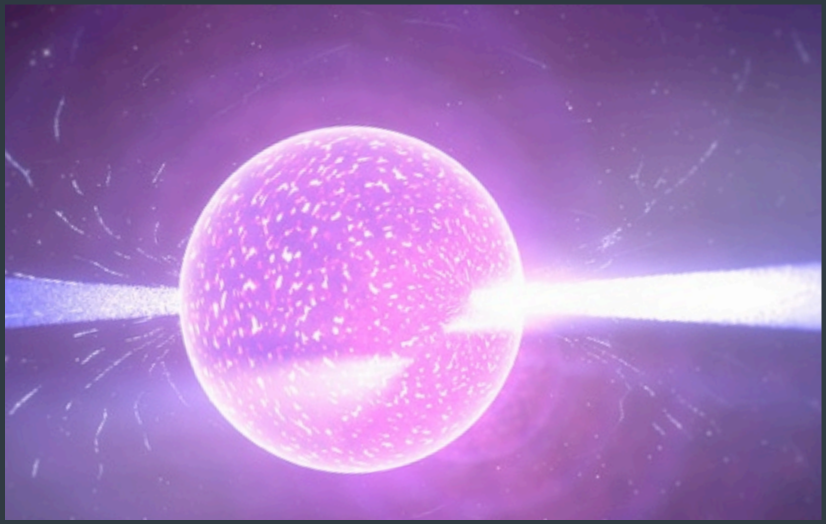
Signals from Space

We can measure the light streaming out of a neutron star's poles, particularly in the radio wavelengths (yes, radio waves are actually a very low-energy form of light! You can't see it with your eyes). The first time Jocelyn Bell and Antony Hewish saw these rhythmic pulse signals, they weren't sure of the source.



How Pulsars Work

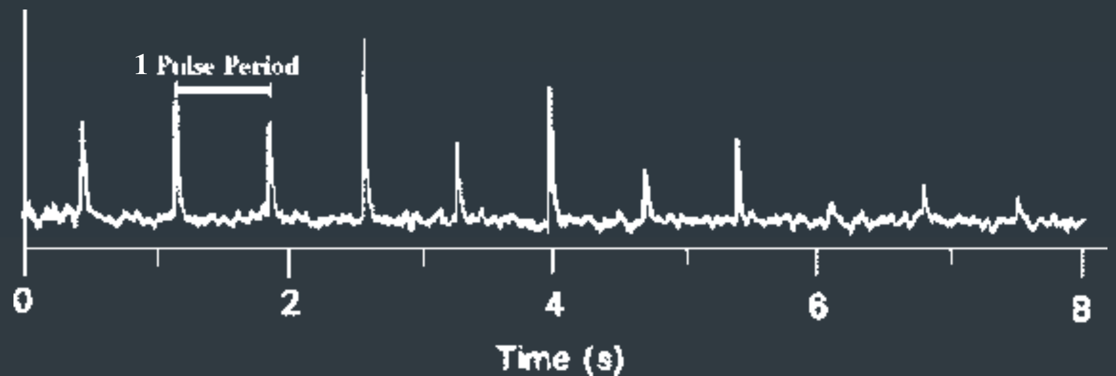
It turns out the signal was from a pulsar. The pulses are regular because the pulsar is spinning, and, like a lighthouse, there's a flash each time the spinning light source shines towards us. The period between pulses is also the period of rotation for the neutron star.



Counting Periods

2 spikes enclose 1 period. 3 spikes enclose 2 periods. *x* spikes enclose *x* - 1 periods. It's a fencepost problem. Every set of periods has a first spike and a last spike. So, if you count spikes, your # periods is # spikes - 1.

For average period, divide total time by number of periods timed.



Mathy Junk

We'll measure the periods of a few neutron stars and use a frequency-distance trick to estimate the distance to one.

$$D = \frac{T_2 - T_1}{124.5((1/f_2)^2 - (1/f_1)^2)}$$

Fin