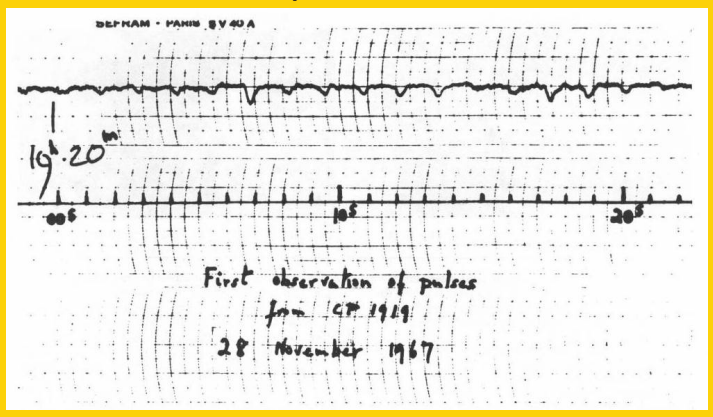
PULSARS: COSMIC CLOCKS

History

The first pulsar was discovered almost by accident in November of 1967 by a graduate student named Jocelyn Bell, who was working with her advisor, Anthony Hewish,

to study twinkling radio galaxies with a telescope they had built over the previous two years in Cambridge, England. They observed successive pulses – spikes in radio intensity on their pen chart data recorder – arriving every 1.33 seconds.

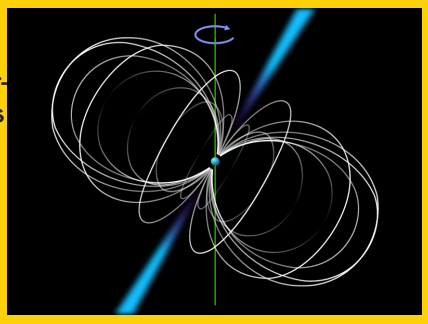
Over the next year, Jocelyn Bell and Anthony Hewish measured the duration of time between pulses – the pulse period – to be 1.3373011 seconds. We now know that this incredible regularity of pulsations is a characteristic property for pulsars in general, but at the time with only one example, it seemed bizarre for such precise cosmic clocks to exist naturally. Some astronomers not-so-jokingly referred to the discovery as "LGM" for Little Green Men.



Regular radio pulses were actually caused by rapidly rotating neutron stars producing narrow beams of radio emission that sweep across our line of sight from Earth – pulsars.

What is a Pulsar?

Born in the dying explosions of massive stars, pulsars are incredibly dense, measuring 15 miles in diameter and weighing a billion tons per teaspoonful. The slowest pulsar spins once every 12 seconds, while the fastest rivals a kitchen blender, spinning 714 times per second. They have magnetic fields that are trillions of times stronger than a typical refrigerator magnet and millions of times stronger than a medical MRI machine. Imagine a spinning atomic nucleus the size of Milwaukee whose magnetic field would simultaneously erase all credit cards on Earth from the moon!



More than 2,500 pulsars have been found since 1967. A network of the most rapid rotators is being used as a Galactic-scale detector, looking for gravitational waves coming from binary supermassive black holes.

The LEDs on our pulsar model represent beams of radio waves; find a vantage point where one crosses your line of sight and see if you can measure the spin period! For more information on how to make your own LED pulsar, scan the QR code.

Scan for more information!

http://www.cgca.uwm.edu/outreach/maker.html

UNIVERSITY of WISCONSIN UWMILWAUKEE

Leonard E. Parker
Center for Gravitation, Cosmology & Astrophysics
at the University of Wisconsin-Milwaukee

NANOGrav
North American Nanohertz Observatory
for Gravitational Waves
Physics Frontiers Center