

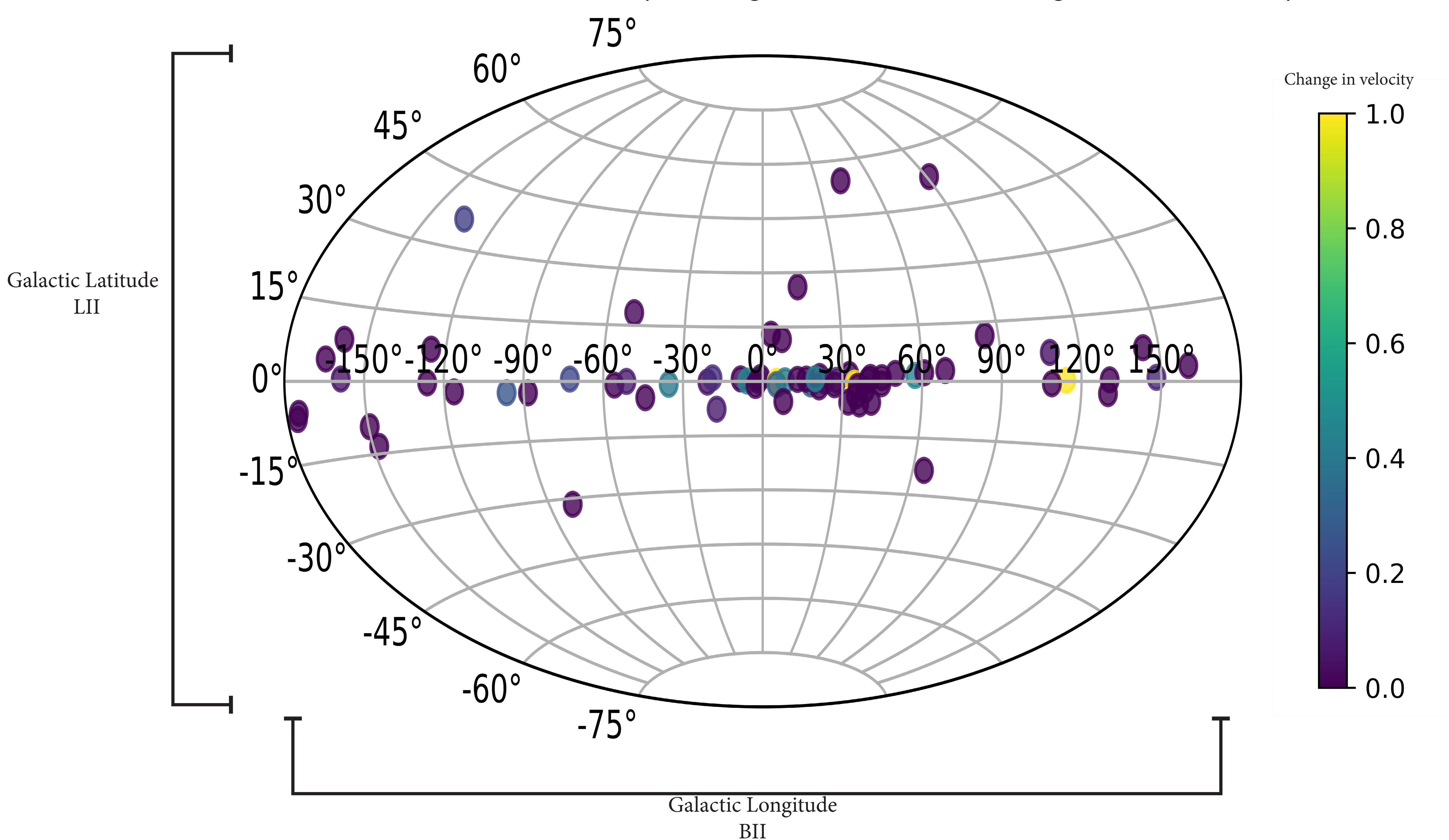
Investigating Why Pulsars Speed Up

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Code

Observations of Velocity Changes on Pulsars Throughout the Galaxy



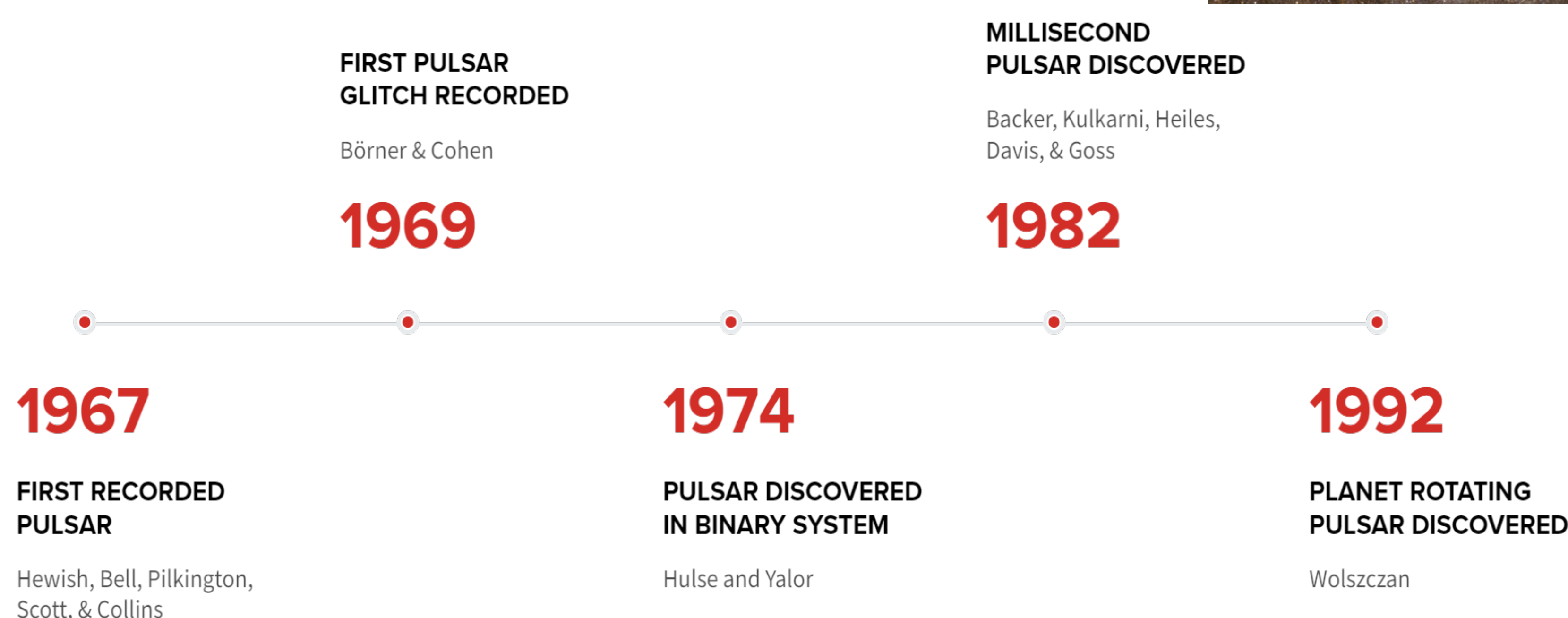
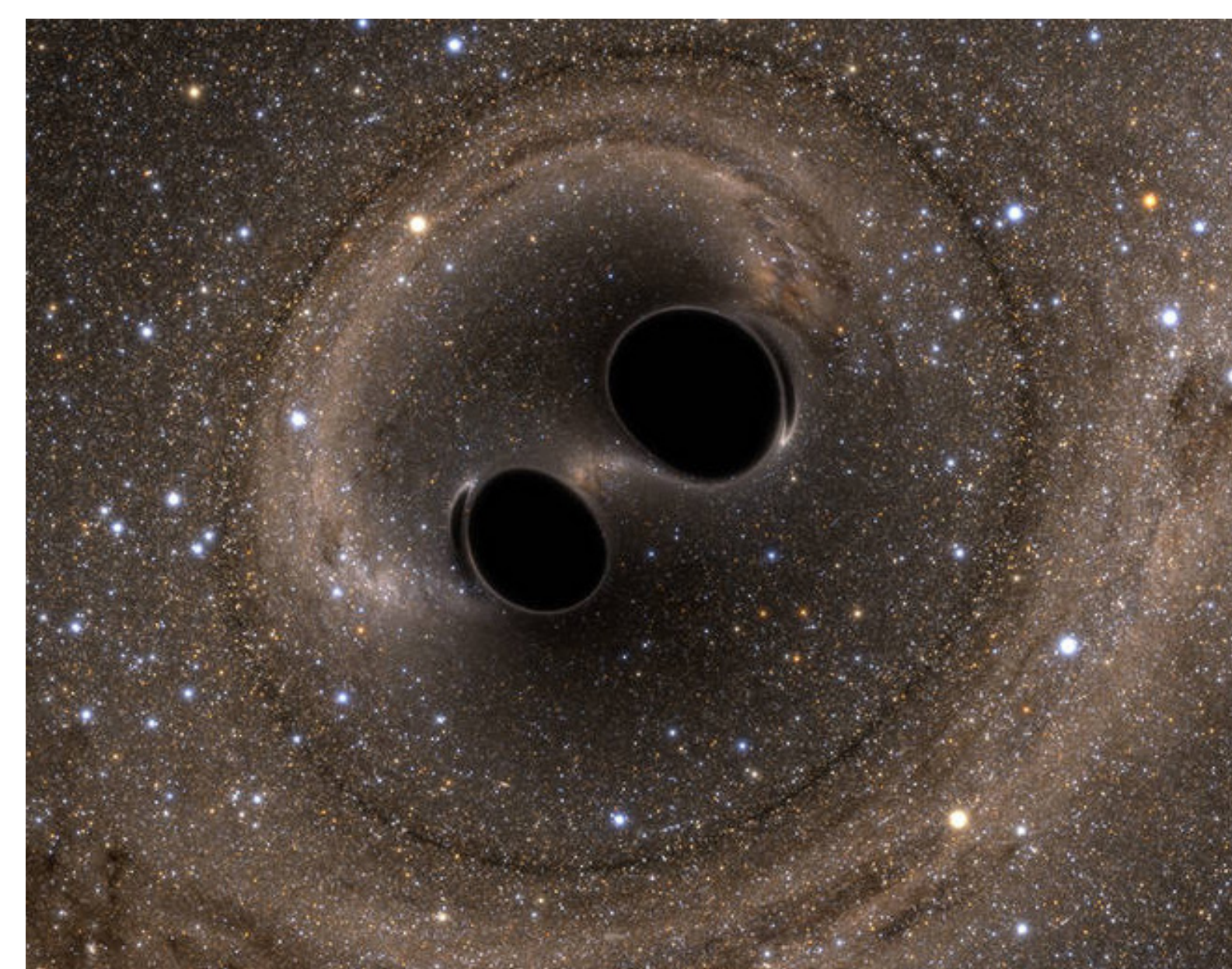
A plot that maps pulsars in space. LII is the galactic latitude, BII is the galactic longitude. The center of the plot (0,0) is the middle of the Milky Way Galaxy. A color map was created to show the average change in velocity during glitch events for each pulsar. A higher mapping (yellow) corresponds to a high change in velocity compared to a lower mapping (purple), which corresponds to a small change in velocity.

Motivation:

Pulsars, highly magnetized and rapidly rotating neutron stars, are thought to be able to provide clues about how our universe works. They contain the densest matter in the universe (other than matter once it has entered a black hole), have emit consistent radio pulses so they work as a natural clock, and many planets rotate around pulsars. They also have extreme gravity and magnetic fields, so scientists can use data from pulsars to better understand the behaviors of physical objects in these extremes. While pulsars are rapidly rotating, their rotational velocity slows down over time. Further research in glitches, a (seemingly random) fractional increase in the rotational velocity of a pulsar, can give us deeper insight into how pulsars work and how physics behaves in these extreme conditions.

Background:

Pulsars are a newly discovered phenomena, with the first pulsar being discovered around 50 years ago. A timeline of major discoveries with pulsars can be seen below; however there are still many more discoveries to be made.



What is a pulsar?

A pulsar is a rapidly rotating, highly magnetized neutron star. They are formed when a supernova occurs in a massive star that isn't large enough to form a black hole.

What is a glitch?

Pulsars slow down over time. A glitch is when there is a fractional increase in the rotational velocity of a pulsar. Currently, there is only speculation as to why this occurs, so this is a very new and interesting topic.¹

What was the project?

The main goal of this project was to try to find a correlation between pulsar parameters (i.e. period, eccentricity, etc) and glitch parameters (i.e. change in velocity, acceleration, etc) to see if any clues could be found for why glitches occur.

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