

Title: Dynamic Analysis of Radio Pulsar B1237+25's Emission and Polarization Modes

Abstract:

Pulsars are rapidly rotating neutron stars with large magnetic fields resulting in plasma emission above the two polar caps. Pulsar B1237+25 exhibits many phenomena of radio pulsar emission including emission modes, orthogonal polarization modes, and nulling. An existing observation consisting of 5209 pulses made by a 305-m Arecibo Observatory in Puerto Rico exhibits lengthy intervals of the three known emission modes—that is, intervals of pulses that differ significantly in total power, polarization, and exhibit distinct average profiles. These multiple changes in emission patterns provide a unique opportunity to explore the three modes of B1237+25. The emission modes were further delineated into their respective orthogonal polarization modes which are defined as independently traveling electromagnetic waves propagating with their electric fields perpendicular to each other. By studying the orthogonal polarization modes of B1237+25, we hope to determine how each emission mode propagates and interacts with the magnetosphere, a pulsar's magnetic field and plasma “atmosphere”, thus determining the mechanism of the three distinct emission modes for this particular pulsar. Finally, the nulls, pulses observed to have little to no emission, which occur in pulsar B1237+25 may provide insight to the mechanism which seemingly causes pulsar emission to cease suddenly. Implications arising from this project's conclusion will yield new perspectives in understanding fundamental emission properties in pulsars.