The Pulsar Tree: Visualizing the Pulsar Population using Graph Theory Techniques. Applications from Binary Pulsars to Fast Radio Bursts

This talk will present an innovative application of graph theory using a type of graph known as the Minimum Spanning Tree (MST). This technique provides a novel tool to visualize and classify the population of pulsars by representing them together with their properties as nodes and edges through the MST, offering relationships and groupings that go beyond the traditional P-Pdot diagram. The application of this method to the entire population of pulsars cataloged in the ATNF reveals behaviors and connections that are not easy to discern with traditional methods.

The MST approach to the population of millisecond pulsars (MSPs) will be demonstrated, highlighting features and identifying possible key candidates for black widows, redbacks, and transitional millisecond pulsars (tMSPs). This could provide new insights into their behaviors and classifications.

In addition, it will be shown how the MST can act as an unsupervised method of classification for fast radio bursts (FRBs), distinguishing between repeaters and non-repeaters. The analysis reveals parts of the MST with a high density of repeaters, suggesting possible repeater candidates and offering a new perspective on the classification of FRBs.
This innovative visualization tool helps to identify targets for future observations and can contribute to the scientific understanding of FRBs by highlighting the importance of certain variables over others concerning what best describes the repetitive character of a source.

Primary authors: RODRÍGUEZ GARCÍA, Carlos (Institute of Space Science (ICE)); TORRES, Diego F. (Institute of Space Science (ICE))

Presenters: RODRÍGUEZ GARCÍA, Carlos (Institute of Space Science (ICE)); TORRES, Diego F. (Institute of Space Science (ICE))