Spatio-temporal Inference Strategies In The Quest For Gravitational-wave Detection With Pulsar Timing Arrays

Stephen Taylor, Vanderbilt University

Supermassive black holes form binary systems as a byproduct of galaxy mergers over cosmic time, emanating gravitational waves in the nanohertz-frequency sensitivity band of networks of Milky Way millisecond pulsars. Pulsar-timing arrays (PTAs) like the North American Nanohertz Observatory for Gravitational waves (NANOGrav) and the International Pulsar Timing Array are poised to chart this new frontier of gravitational wave discovery within the next several years. The initial detection is expected to be the aggregate gravitational-wave signal over the entire binary population, forming a stochastic background. I will discuss the modeling and statistical inference strategies that underpin the search for this spatially-correlated low-frequency stochastic signal in decades of data from dozens of pulsars. I will also present new results from NANOGrav's most recent search that indicate an emerging statistically-common stochastic process in our pulsars, and finish by discussing some milestones on the road to the exciting next decade of PTA discovery.