



Contribution ID : 96

Type : **Contributed talk**

Quasars with Periodic Variability: Capabilities and Limitations of Bayesian Searches for Supermassive Black Hole Binaries in Time-domain Surveys

venerdì 30 giugno 2023 15:30 (15)

Supermassive black hole binaries lurk, often unseen, in the centers of post-merger galaxies, and numerous electromagnetic surveys are seeking evidence of these dynamic duos' effects on their host galaxies. In this talk I'll discuss our recent paper, which analyzed the capabilities of promising methods to search for electromagnetic signatures of supermassive black hole binaries in current and future time domain surveys, including the Catalina Real-Time Transient Survey (CRTS) and the upcoming Legacy Survey of Space and Time (LSST). In this paper, we used Bayesian methods to disentangle periodic SMBHB signals from intrinsic damped random walk variability in AGN light curves. Through a careful analysis of parameter estimation and Bayesian model selection, we investigated the range of parameter space for which binary systems can be detected, and determined that the false-detection rate depends on the quality of the data and is minimal in LSST. I'll also discuss the promising implications this work has on the possibilities for multi-messenger astrophysics through partnerships with pulsar timing arrays, such as the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), which search for gravitational waves from these binaries.

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Session Classification : Methods and techniques