Contribution ID: **1** Type: **not specified**

Reliable Identification of Binary Supermassive Black Holes with Rubin Observatory Time-Domain Monitoring

Monday, 22 July 2024 15:25 (20 minutes)

Periodic signatures in time-domain observations of quasars have been used to search for binary supermassive black holes (SMBHs). These searches, across existing time-domain surveys, have produced several hundred candidates. The general stochastic variability of quasars, however, can masquerade as a false-positive periodic signal, especially when monitoring cadence and duration are limited. In this work, we predict the detectability of binary SMBHs in the upcoming Rubin Observatory Legacy Survey of Space and Time (LSST). We apply computationally inexpensive sinusoidal curve fits to millions of simulated LSST Deep Drilling Field light curves of both single, isolated quasars and binary quasars. Period and phase of simulated binary signals can generally be disentangled from quasar variability. Binary amplitude is overestimated and poorly recovered for two-thirds of potential binaries due to quasar accretion variability. Quasars with strong intrinsic variability can obscure a binary signal too much for recovery. We also find that the most luminous quasars mimic current binary candidate light curves and their properties: false-positive rates are 60% for these quasars. The reliable recovery of binary period and phase for a wide range of input binary LSST light curves is promising for multi-messenger characterization of binary supermassive black holes. However, pure electromagnetic detections of binaries using photometric periodicity with amplitude greater than 0.1 magnitude will result in samples that are overwhelmed by false positives. This work represents an important and computationally inexpensive way forward for understanding the true and false-positive rates for binary candidates identified by Rubin.

Funding request, please specify

Any funding available for a US graduate student would be greatly appreciated, especially to cover the cost of airfare and lodging.

Primary authors: Prof. TRUMP, Jonathan R. (University of Connecticut); DAVIS, Megan C. (University of Connecticut)

Co-authors: Dr WITT, Caitlin A. (Northwestern University); CASEY-CLYDE, J. Andrew (University of Connecticut/Yale); Prof. RUNNOE, Jessie C. (Vanderbilt); Prof. BLECHA, Laura (University of Florida); Dr CHARISI, Maria (Institute of Astrophysics- FORTH); Prof. BRANDT, W. Niel (The Pennsylvania State University)

Presenter: DAVIS, Megan C. (University of Connecticut)

Session Classification: Binary SMBH