DEVELOPMENT OF A TIME-DOMAIN PIPELINE FOR DETECTING BINARY SUPERMASSIVE BLACK HOLES IN THE UPCOMING LEGACY SURVEY OF SPACE AND TIME (LSST)

V. RADOVIĆ[1] and A. KOVAČEVIĆ[2],D. ILIĆ [1], R. STREET [3] , L. Č. POPOVIĆ, [1,2,4], M. NIKOLIĆ [1]
N. ANDRIĆ MITROVIĆ [1], I. ČVOROVIĆ-HAJDINJAK [1]

[1] *Deaprtment of Astronomy, University of Blegrade, Studentski trg 16, 11000 Belgrade, Serbia*
E–mail rviktor@matf.bg.ac.rs

[2]*Fellow of Chinese Academy of Sciences President's International Fellowship Initiative (PIFI)*

[3] *Las Cumbres Observatory, 6740 Cortona Drive, Suite 102,Goleta, CA 93117, USA*

[4] *Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia*

Abstract.

The Vera C. Rubin Observatory's Legacy Survey of Space and Time (LSST) will radically change our view of the universe as it will continuously be observing around 18 000 squared degrees of the southern sky. It is expected that LSST will detect an unprecedented sample of Active Galactic Nuclei (AGNs), approximately around 300 million. However, obscuration and host-galaxy dilution will restrain AGN selection so that the final sample will consist of up to 20 million active supermassive black holes. The study of AGN variability is going to be one of the main investigation tasks which will be done by the LSST, as it is expected that millions of well-sampled, multicolor light curves will be available.

The LSST community has accepted two in-kind contributions from the Serbian AGN group (SER-SAG). One of them is a time-domain periodicity mining pipeline, whose primary objective is the detection of oscillation signals from the plasma environment of close binary supermassive black holes in the LSST light curves.

The pipeline will be written as a Python-based, open-source application whose output will be the extracted light curve periodic properties (periodicities, uncertainties, and periods likelihood). Additionally, the program will provide at least four different time-domain algorithms, as well as parametric and non-parametric preprocessing unit of the input LSST light curves. Furthermore, a catalog of robust close binary candidates for the next generation gravitational wave observatories focused on detecting the nano Hertz gravitational waves will be prepared.

Our in-kind contribution began in January 2022, and in this talk, we will present half-yearly updates on its advancement. We will demonstrate the pipeline's initial testing and the plan for future actions. By analyzing massive LSST AGN variability data, we expect to find or usefully constrain the uncertain frequency of close binary SMBHs.