

ADVANCED NONLINEAR ANALYSIS FOR DETECTING BINARY QUASARS AND TRANSIENT EVENTS IN THE LSST ERA

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Abstract. We present the completion of the Quasar harmonic eXplorer (QhX) and Quasar Neural Process Python (QNPpy), a directable software in-kind contribution to the operations of the Vera C. Rubin Legacy Survey of Space and Time (LSST, Breivik et al 2022). QhX (Kovačević et al 2018,2019) and QNPpy (Pavlović et al in prep) are designed to facilitate the nonlinear analysis of quasar emission with the aim of detecting close binary quasar (Kovačević 2024) and transient event candidates (Ilić et al 2020).

The presence of subparsec binary quasars in some galactic centers is assumed to be a key source of nHz gravitational waves, with electromagnetic radiation emitted in various forms during the inspiral phase. QhX addresses the significant challenges posed by non-sinusoidal signals, low signal-to-noise ratios, and red noise in quasar light curves, which complicate the detection of periodic signals using traditional methods. Our innovative approach employs the ‘2DHybrid’ method, an extension of two-dimensional correlation spectroscopy (Kovačević 2024), tailored for quasar emission curve analysis. QNPpy complements QhX by applying deep learning model to analyze light curves with respect of presence of transient signals.

References

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