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MALLORN: Simulating LSST Nuclear Transients from Real Observations

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The Vera C. Rubin Observatory's 10-Year Legacy Survey of Space and Time (LSST) is expected to revolutionise time-domain astronomy, with a hundredfold increase in detected transients. For tidal disruption events (TDEs) in particular, this will increase the population of observed objects from ˜100 to ˜30,000. As TDEs are a relatively recent discovery with a small catalogue of objects, many questions remain: Can we observe intermediate black holes via tidal disruption events? Why do TDEs exhibit an apparent preference for green valley galaxies? How common are repeated tidal disruptions? LSST offers an excellent opportunity to answer these questions.

However, the sheer volume of data and detections that LSST will produce presents an inherent challenge to astronomers. We do not have adequate resources to follow up on every object that LSST will discover, so it will be necessary to prioritise a fraction of the objects.

To assist with maximising LSST's scientific potential and effectively preparing to handle the vast volume of data it will create, we have developed the Many Artificial LSST Lightcurves based on Observations of Real Nuclear transients (MALLORN) data set. MALLORN consists of over 10,000 simulated LSST lightcurves generated from Zwicky Transient Facility (ZTF) photometry, Gaussian processes, machine learning approaches, SNCosmo SED simulations and the Rubin Survey Simulator. By grounding the simulated lightcurves in real ZTF observations, this approach produces a realistic and representative LSST training set with minimal assumptions about the underlying physics of the lightcurves.

We will show how the MALLORN algorithm can be used to simulate transients in any survey given an observed population from a previous survey, and report on the results of our classification challenge. We will also show how we are using these data sets to design triggering criteria for real transients to follow-up rising transients while rejecting faint AGN.

Note: The acronym MALLORN is a reference to the golden-leaved Mallorn trees of Lothlórien

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