

Looking for Orphan gamma-ray burst in the Rubin LSST data with the FINK alert broker

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Gamma-ray bursts are highly energetic cosmological objects that provide us with different paths towards a better understanding of fundamental physics and the evolution of the universe. The most recent, promising and innovative path developed, consists in estimating the Hubble cosmological constant from gravitational wave events for which the distance can be estimated through electromagnetic observations. The perfect case was the one of GW170817/GRB170817A, and indeed several initiatives are well underway to try to optimize the matching of on-axis GRB signal (prompt, afterglow, kilonova) with potentially sub-threshold gravitational waves.

What we propose here is to provide new electromagnetic candidates for this matching by trying to identify off-axis GRBs in the Rubin LSST data through their so-called orphan optical afterglow emission. We will present our early work on this topic, starting with simulations with the `afteglowpy` package of off-axis GRB afterglow light curves on a large part of the phase space of the parameters : energy, distance, jet nature and geometry, burst environment. This set of simulation helped us to understand that indeed some orphan afterglows should appear in Rubin LSST data as faint and slow transients that could be observable for several months.

We then produced a population of short GRBs off-axis afterglows for which we ran pseudo-observations using the `"rubin_sim"` package that offers a realistic schedule of the 10 years long observations of the LSS, and generated fake alerts ingested by the FINK alert broker. With that setup we are ready to dive into the characterization and identification of orphan afterglow light curves, we'll present our views on the most promising paths forward.

Primary author: Dr BREGEON, Johan (CNRS/IN2P3/LPSC - Univ. Grenoble Alpes)

Presenter: Dr BREGEON, Johan (CNRS/IN2P3/LPSC - Univ. Grenoble Alpes)

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