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# Looking for orphan gamma-ray bursts in the Rubin LSST data with the FINK broker

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Gamma-ray bursts are the most violent phenomena in the universe and are characterized by a bright ultra-energetic flash of gamma rays lasting from a few seconds to several days. From constraints on the energetics, the emission that is observed at Earth has to come from a highly relativistic beam with an opening angle of just a few degrees and bulk Lorentz factor that can reach a thousand.

What happens however if the beam is not exactly oriented toward the observer?
From simple geometrical consideration, models predict that the gamma ray emission becomes too faint but that emission from the afterglow at lower energies (optical to radio) might peak several days to month later and might be observable.
So far, no such phenomenon could be clearly identified but Rubin LSST data are expected to host tens of such orphan afterglows each year: these are called orphans, because these would be gamma-ray burst with no gamma emission seen.

Rubin LSST will however identify hundreds of thousands of transients each night, so that multiple communities are setting up efficient transient alerts brokers to keep up with that pace. The FINK broker developed at IN2P3 will hence be the primary tool to scan, filter and analyze the Rubin LSST alert stream to try identify orphan afterglows.

I'll briefly present initial work done with a student to look for orphan afterglow in the ZTF alert stream made available through the FINK science portal, and present my plans to move forward to get ready for Rubin LSST data.

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