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Study the blazar variability through ZTF/LSST and the CTAO with Fink

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To date, blazars constitute the largest population of objects in the extragalactic gamma-ray sky. They generate over 50% of the extragalactic diffuse gamma-ray background photon flux at energies higher than 100 MeV. They are a subclass of active galactic nuclei that exhibit a relativistic jet pointing towards Earth at an angle of less than 10°. Their electromagnetic emission spans from radio to TeV gamma rays, with half of their power emitted in the latter range.
The emission and acceleration processes of blazars remain a mystery to the scientific community. The typical model used to describe the emission spectrum of blazars accounts for synchrotron emission in the optical range and inverse Compton emission in the gamma-ray range, suggesting a possible correlation between the two wavelengths. The acceleration of particles in the jet up to TeV energies is one of several extreme properties of blazars. Other notable features include their extreme variability in emission with no typical timescale (ranging from minutes to years). Studying this variability would improve our understanding of the aforementioned acceleration and emission processes.
This variability highlights the importance of observing blazars in different states to investigate various scientific phenomena. First, we will describe the Fink tools that enable such a follow-up programme. This programme is necessary for both optical blazar observations and possible gamma-ray follow-ups from the CTAO triggered by LSST. Next, we will examine the duty cycle of blazar emission activity to gain insight into their properties (e.g. the Fourier index).

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