

# 12 years of quasi-periodic gamma-ray oscillations of PG 1553+113 seen by Fermi LAT

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We present the results of twelve years of Fermi Large Area Telescope (LAT) monitoring observations of the high-energy peaked BL Lac object PG 1553+113. The Fermi-LAT ( $E > 100$  MeV) results are complemented by simultaneous, multi-wavelength data at lower energy bands, including the optical band. Our previous work published in 2015 revealed the presence of a  $\sim 2$  years periodic modulation in the observed source flux. The newly acquired dataset that will be presented here accounts for five additional years of observations, including a dedicated monitoring campaign at X-ray energies performed by the Neil Gehrels Swift Observatory, and new optical polarization data. The temporal and cross-correlation analysis of this rich multifrequency dataset confirms the previous findings, i.e., a  $\sim 2$ -year, nearly periodic flux oscillation, that modulates the light curves and flares of PG 1553+113. Energy-dependent features were found, which confirm the modulation with higher significance at higher energies. Our findings provide further support that the periodicity is intrinsic to the blazar, and could be caused by e.g., a gravitationally bound system of binary supermassive black holes or the influence of massive stellar-sized objects on the central black hole, among other scenarios.

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