Preprint Series in Particles and Cosmos Physics
nº IPARCOS-UCM-26-019

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Testing X-ray Periodicity and Long-Term Trend in PG 1553+113 via Targeted Swift-XRT Monitoring

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April 2026

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Abstract

PG~1553+113 is the blazar with the most-significantly detected periodic patter in its multiwavelength (MWL) emission, making it one of the most promising candidates for hosting a supermassive black hole binary. However, the presence of this periodic behavior in the X-ray band remains under debate, largely due to the lack of continuous monitoring. This has led to differing conclusions in previous studies. In addition, we aim to examine whether the recently identified linear long-term trends in the gamma-ray and optical bands also exist in the X-ray regime. Here, we evaluate the 2.1-year period in the X-ray light curve of PG 1553+113 using two dedicated monitoring campaigns with Swift-XRT and UVOT, guided by predictions of future oscillation phases. We also examine whether the long-term trend is present in X-rays, the potential periodic behavior of the X-ray power-law photon index, and its potential correlation to the X-ray flux. As a result, we find tentative evidence for a correlation between the predicted high-emission states in the gamma-ray band and those observed in the X-ray and UV bands. Therefore, we do not find a strong evidence of the same periodic pattern in X-ray. In addition, we find that the X-ray light curve is consistent with the presence of a long-term linear trend, in agreement with those previously reported in gamma-ray, optical, and radio. Overall, these results indicate that the X-ray emission is likely to share the same long-term behavior observed in the gamma-ray and optical bands. Nevertheless, the pronounced stochastic variability that characterizes the X-ray light curve limits our ability to draw firm conclusions regarding the presence of the periodic behavior.

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