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Exploring the Puzzling VHE Lightcurve of the Gamma-ray Binary LMC P3

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Gamma-ray binaries are a rare class of high-mass binary systems where the peak of their spectral energy distribution occurs in the gamma-ray energy range. These systems have proven to be excellent laboratories for studying particle acceleration mechanisms. One such system is LMC P3, the most luminous gamma-ray binary discovered to date and, so far, the only one found outside the Milky Way. It is composed of an unknown compact object and an O5 III star, and is located in the Large Magellanic Cloud. LMC P3 exhibits an orbital period of 10.3 days and was initially discovered in Fermi-LAT data. The peak of the high-energy (HE; 100 MeV-100 GeV; phase 0) emission is near the superior conjunction of the compact object. H.E.S.S. subsequently reported the detection of very high-energy (VHE) gamma-ray emission during only 20% of the orbit, between orbital phases 0.2 and 0.4. This roughly corresponds to the inferior conjunction of the compact object and is in anti-phase with the Fermi-LAT light curve. However, using the existing orbital solution, a modelled inverse Compton light curve that is modulated only by gamma-gamma absorption, peaks earlier than the observed peak. In this work, we will present attempts to interpret the TeV light curve in the context of emission and absorption mechanisms and explore alterations to the orbital solution within error margins.

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