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Refining the orbital solution of the gamma-ray binary LMC P3

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Gamma-ray binaries are high-mass binary systems that emit predominantly in the high-energy and very-high-energy gamma-ray regimes. LMC P3 is the only known gamma-ray binary located outside our galaxy and consists of an O5,III companion star and a compact object with a mass in the range of a neutron star or a black hole. The leading theory is that all gamma-ray binaries contain a young, non-accreting pulsar, with the non-thermal emission produced in a shock which forms between the pulsar and the stellar wind. The gamma-ray light curves show that the emission from LMC P3 peaks around the phases of inferior and superior conjunction, at GeV and TeV energies respectively. However, the TeV peak occurs later than expected, even after accounting for gamma–gamma absorption. Refining the orbital solution for this source is crucial for understanding how very high energy emission is produced in this system. This motivated further observations with SALT–HRS to better constrain the phase of periastron. We present preliminary results of a refined orbital solution, which indicate a slightly more eccentric orbit and an earlier phase of periastron, and discuss how this will influence modelling of the very-high-energy emission.

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