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Unveiling the Super-orbital Modulation of LS I +61 303 in X-rays

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LS I +61 303 is one of a handful of high-mass X-ray binaries that have been detected at all frequencies through radio to TeV. Its nature is still under debate, with rotationally powered pulsar-composed systems and microquasar jets being discussed. LS I +61 303 is a very bright TeV source and one of the 15th brightest GeV sources detected by Fermi. However, it enters a low TeV state and its Fermi MeV-GeV emission has declined in recent years for an unknown reason.

We found evidence from the longest monitoring of LS I +61 303 done to date by RXTE for the 1667 days super-orbital modulation in X-ray, which is probably related to the recent low state of very high energy emission. The 1667 days super-orbital period has already been detected at non-contemporaneous radio and optical measurements. We have found in phase super-orbital variability between optical frequencies and X-ray. However, the super-orbital variability at radio frequencies and X-ray are not consistent in phase, a 281.8 +/- 44.6 days shift are discovered.

The multi-wavelength phenomenology in super-orbital modulation of LS I + 61 303 and in particular, the recent low TeV emission, can be explained in the context of a high magnetic field, slow period pulsar model. In that case, LS I +61 303 system would most likely be subject to a flip-flop behavior, from a rotationally powered ejector regime in apastron to a propeller regime in periastron along each of the system’ s eccentric orbits. With long term variation of the accreted mass, these observed multi-wavelength behaviors are expected from LS I +61 303.

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