Honours project: Super-orbital modulation of the Be disc in LS I +61 303

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Project context and summary

Gamma-ray binaries consist of a compact object, either a neutron star or a black hole, orbiting an early-type O/Be star. To date, only a handful of gamma-ray binary stars (fewer than 10) have been discovered. These stars exhibit emission across the entire electromagnetic spectrum, typically modulated by the orbital period of the compact object. Due to uncertainties about the nature of the compact object, two main scenarios have been proposed to explain the observed multiwavelength emissions (Fig. 1): the accretion (microquasar) model and the pulsar wind model. Analysing multiwavelength data for each object can help differentiate between these two scenarios.

One such gamma-ray binary system, LS I +61 303, is composed of a Be star and an unknown compact object, and it has been extensively studied across all wavelengths. In addition to its 26.5-day orbital period, the system exhibits a long-term superorbital period of 4.6 years, which is observed throughout the entire electromagnetic spectrum, though its origin remains unclear. One possible explanation for the superorbital modulation is a precessing eccentric Be disk. This project aims to investigate this scenario by utilising optical spectroscopic observations from the Liverpool Telescope, focusing on the analysis of the Hα emission line.

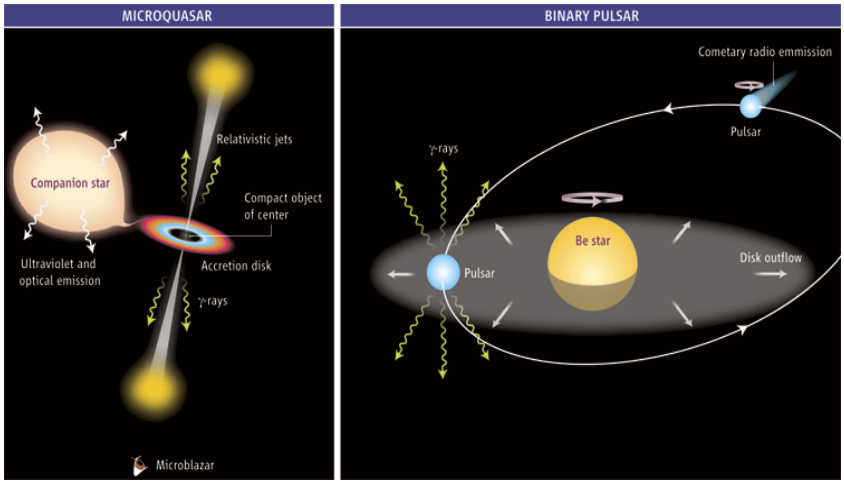

Figure 1: The microquasar (left) and pulsar wind model (right) for gamma- ray