J54a Accretion vs colliding wind models for the gamma-ray binary LS I +61 303

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LS I +61 303 is a puzzling Be/X-ray binary with variable gamma-ray emission at up TeV energies. The nature of the compact object and the origin of the high-energy emission are unclear. One family of models invokes particle acceleration in shocks from the collision between the B-star wind and a relativistic pulsar wind, while another centers on a relativistic jet powered by accretion. Recent high-resolution radio observations showing a putative "cometary tail" pointing away from the Be star near periastron have been cited as support for the pulsar-wind model. In order to carry out a quantitative assessment of these competing models for this extraordinary source, we apply a 3D SPH code for dynamical simulations of both the pulsar-wind-interaction and accretion-jet models. When one accounts for the 3D dynamical wind interaction under realistic constraints for the relative strength of the B-star and pulsar winds, the resulting form of the interaction front does not match the putative "cometary tail" claimed from radio observations. On the other hand, dynamical simulations of the accretion-jet model indicate that the orbital phase variation of accretion power includes a secondary broad peak well away from periastron, thus providing a plausible way to explain the observed TeV gamma ray emission toward apastron. We conclude that the colliding-wind model is not clearly established for LS I +61 303, while the accretion-jet model can reproduce many key characteristics of the observed TeV gamma-ray emission.