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Connecting Data and Simulations of the Gamma-Ray Binary LS 5039

Bachelorarbeit - Sommersemester 2025

Context/Keywords: Astroparticle Physics; Ground-Based Gamma-Ray Astronomy; Analysis Methods

Supervisors: Markus Holler, Ralf Kissmann

Abstract

During the last two decades, the field of ground-based gamma-ray astronomy with Imaging Atmospheric Cherenkov Telescopes (IACTs) has matured into an important part of Astroparticle Physics, expanding our knowledge about the universe on the high-energy end. Among the different source classes detected with IACTs are binary systems such as LS 5039. It consists of an O-type star and a massive companion, which is typically assumed to be a pulsar. The interaction of the stellar and the pulsar wind are assumed to form a shock region, which in turn results in particle acceleration and subsequently gamma-ray emission. In this BSc thesis you are going to analyse LS 5039 data from the H.E.S.S. array of IACTs and compare the resulting energy spectrum to corresponding simulations.

Helpful Skills

- Basic knowledge of *python* or programming in general
- Interest in analysis methods as well as ground-based gamma-ray astronomy

Left: The H.E.S.S. array of IACTs in Namibia. Picture credit: Vikas Chander.
Middle: Simulation of the mass density in the LS 5039 system. Credit: R. Kissmann et al. (2023)
Right: H.E.S.S. sky map of the field of view containing LS 5039. Credit: H.E.S.S. collaboration