Resolving Particle Acceleration in RX J1713.7-3946 with Advanced Gamma-Ray Imaging Methods

Bachelorarbeit - Sommersemester 2024

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Supervisor: Markus Holler

Abstract

One of the main quests of Astroparticle Physics is to identify the sources of Cosmic Rays. In the last two decades, some supernova remnants (SNRs) turned out to be strong Galactic emitters of very high energy (VHE, E > 100 GeV) gamma-rays, allowing to trace the acceleration of Cosmic Rays. The SNR RX J1713.7-3946 stands out as a strong VHE gamma-ray source whose emission correlates with that observed in X-rays (see below). However, the comparably poor angular resolution of ground-based gamma-ray telescopes such as H.E.S.S. complicates the identification of specific particle acceleration sites.

Using a method called "Adaptive Kernel Density Estimation", we are now able to create better-resolved images of ground-based gamma-ray data. The goal of this Bachelor topic is to apply the Adaptive Kernel Density Estimation method to H.E.S.S. data from RX J1713.7-3946 to get a "better look" at this SNR in VHE gamma-rays. The result should allow to better identify the particle acceleration therein and can be compared to the emission seen in X-rays.

Helpful Skills

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

Bottom left: The H.E.S.S. array of IACTs in Namibia. Picture credit: Vikas Chander.
Bottom middle: RX J1713.7-3946 as seen with the H.E.S.S. telescopes with classical imaging methods (H.E.S.S. Collaboration 2016)
Bottom right: X-ray image of RX J1713.7-3946