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Creating a high-resolution picture of Cygnus with the Cherenkov Telescope Array

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The Cygnus region hosts one of the most remarkable star-forming regions in the Milky Way. Indeed, the total mass in molecular gas of the Cygnus X complex exceeds 10 times the total mass of all other nearby star-forming regions. Surveys at all wavelengths, from radio to gamma-rays, reveal that Cygnus contains such a wealth and variety of sources—supernova remnants (SNRs), pulsars, pulsar wind nebulae (PWNe), Hii regions, Wolf-Rayet binaries, OB associations, microquasars, dense molecular clouds and superbubbles—as to practically be a galaxy in microcosm. The gamma-ray observations along reveal a wealth of intriguing sources at energies between 1 GeV and tens of TeV. However, a complete understanding of the physical phenomena producing this gamma-ray emission first requires us to disentangle overlapping sources and reconcile discordant pictures at different energies. This task is made more challenging by the limited angular resolution of instruments such as the Fermi Large Area Telescope, ARGO-YBJ, and HAWC and the limited sensitivity and field of view of current imaging atmospheric Cherenkov telescopes (IACTs). The Cherenkov Telescope Array (CTA), with its improved angular resolution, large field of view, and order of magnitude gain in sensitivity over current IACTs, has the potential to finally create a coherent and well-resolved picture of the Cygnus region between a few tens of GeV and a hundred TeV. We describe a proposed strategy to study the Cygnus region using CTA data, which combines a survey of the whole region at $65^\circ < l < 85^\circ$ and $-3.5^\circ < b < 3.5^\circ$ with deeper observations of two sub-regions that host rich groups of known gamma-ray sources.

Collaboration

CTA

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