

The sensitivity of the Cherenkov Telescope Array to gamma-ray emission from the Perseus galaxy cluster

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We estimate the sensitivity of the Cherenkov Telescope Array (CTA) to detect diffuse gamma-ray emission from the Perseus galaxy cluster, both from interactions of cosmic rays (CR) with the intra-cluster medium, or as a product of annihilation or decay of dark matter (DM) particles in case they are weakly interactive massive particles (WIMPs). The observation of Perseus constitutes one of the Key Science Projects to be carried out by the CTA Consortium in the first years of operation. In this talk, we will focus on the DM-induced component of the flux. Our DM modeling includes the substructures we expect in the main halo of Perseus, as predicted within the standard cosmological model hierarchical structure formation scenario, which will boost the annihilation signal significantly. We compute the expected CTA sensitivity using a likelihood maximization analysis including the most recent CTA instrument response functions. We also model the expected CR-induced gamma-ray flux in the cluster, and both DM- and CR-related uncertainties via nuisance parameters. We will show the sensitivity of CTA to discover, at best, diffuse gamma-rays in galaxy clusters for the first time. Even in absence of signal, we show that CTA will allow us to provide stringent and competitive constraints on TeV DM, that will rely on state-of-the-art modeling of the cluster's DM distribution. Finally, we will discuss the optimal strategy for CTA observations of Perseus.

Keywords

dark matter; galaxy cluster; Perseus; halo model; substructure boost; likelihood analysis

Collaboration

CTA

other Collaboration

Subcategory

Future projects

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