

Cosmic rays, neutrinos and GeV-TeV gamma rays from Starburst Galaxy NGC 4945

Thursday, 26 November 2020 13:10 (0:20)

Content

The detection of high-energy astrophysical neutrinos and ultra-high-energy cosmic rays (UHECRs) provides a new way to explore the sources of cosmic rays. One of the highest energy neutrino events detected by IceCube, tagged as IC35, is close to the UHECRs anisotropy region detected by Pierre Auger Observatory. Recently, Pierre Auger collaboration showed that nearby starburst galaxies (SBGs) could reproduce the UHECR signal's morphology with a 4 σ confidence level. The nearby SBG, NGC 4945, is close to this anisotropic region and inside the mean angular error of the IC35 event. We consider a hypernova located in the SB region of NGC 4945, which can accelerate protons up to $\sim 10^{17}$ eV and inject them into the interstellar medium. We show that the interaction of these protons with the gas density of the SB region can explain Fermi-LAT gamma-ray observations. Our estimated PeV neutrino events, in ten years, for this source is approximately 0.32, which shows that IC35 is not produced in the central region of this SBG. Finally, we consider the superwind region of NGC 4945 and show that cosmic-ray protons cannot be accelerated in it up to UHEs. Therefore, in our scenario, NGC 4945 contribution to the UHECRs is negligible.

Summary

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