

H.E.S.S. observations of composite Seyfert–starburst galaxies

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Composite galaxies, containing both a starburst and Seyfert component, may produce very-high-energy (VHE; > 100 GeV) γ -ray emission at vastly different spatial scales ranging from several Schwarzschild radii of a supermassive black hole (SMBH) to a dozen kiloparsecs. In addition to core-collapse supernova remnants, various sources have been suggested to explain multiwavelength and/or multi-messenger neutrino and ultra-high-energy-cosmic-ray (UHECR) data collected on composite galaxies.

The closest composite Seyfert–starburst galaxies, NGC 1068, the Circinus galaxy, and NGC 4945, are observed with the High Energy Stereoscopic System (H.E.S.S.) to determine whether they are very high-energy γ -ray emitters and to provide stringent constraints on cosmic-ray populations in these systems.

Data obtained in dedicated H.E.S.S. observations have been analysed to search for VHE γ -ray counterparts to the detected Fermi-LAT GeV γ -ray signals and for potential spectral components substantially emitting in the VHE range.

No signals have been found in these H.E.S.S. data. Upper limits on the VHE γ -ray fluxes are derived and are compared to models, involving starburst activities in NGC 1068 and NGC 4945, kiloparsec-scale bubbles in NGC 1068 and the Circinus galaxy, possible multiple components in NGC 4945 previously suggested from Fermi-LAT data, propagation of VHE γ rays for a SMBH surrounded by gas or photons in NGC 1068, and lastly, hypothetical sources of UHECRs in NGC 4945.

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