Understanding the origin of the extended gamma-ray emission and the physical nature of HESS J1841-055 using observations at TeV energies with the MAGIC telescopes

Executive summary

This contribution is about unveiling the nature of an unidentified extended γ-ray emission with the MAGIC telescopes. This provides detailed spectral and morphological analyses of the source which enable us to understand the extended γ-ray emission and physical properties of such a source.

With the improved sensitivity with respect to the previous generation, current space-borne and ground-based γ-ray telescopes have made the number of γ-ray sources detected at GeV-TeV energies increase many folds over the last decade. Many of the detected extended γ-ray sources are not associated with any known sources at other wavelengths. Understanding the nature of these sources and the origin of the observed high energy γ-ray emission remains a great challenge and interesting subject of study.

Using the MAGIC telescopes, we have observed one such unassociated γ-ray source, named HESS J1841-055 discovered by H.E.S.S. at TeV energies. We investigate the physical nature and origin of the γ-ray emission from this extended source. We performed energy dependent morphological and spectra analysis. We also investigated the low energy counterparts to find out their associations with the extended γ-ray emission. In this conference, we present the results of our detailed investigation on this source using MAGIC data and other multi-waveband information on nearby sources.

Our deep study of this unidentified source at TeV energies shows that the observed γ-ray emission is significantly extended and is consistent with other measurements. Within the present morphological and spectral studies of this extended source using GeV--TeV data and available multiwaveband information on sources present within the region, we find that the extended γ-ray emission appears to be associated with multiple sources in this region. The observed spectral energy density can be explained well with both a leptonic (bremsstrahlung) and a hadronic model for the ambient matter density of 100 cm^{-3} assuming a broken power-law distribution of electrons and protons, respectively. The GeV--TeV emission is compatible with a pulsar wind nebula scenario, although a fraction of the γ-ray emission can also be explained within a supernova remnants scenario. However, disentangling these sources at TeV energies (either point sources or extended sources) one from another and quantifying their contribution to the

observed morphology of the source demands much better angular resolution compared to the present generation of γ-ray telescopes. Hence, HESS J1841-055 naturally becomes an interesting source of study for the next generation of IACT telescopes.