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Extreme Galactic particle accelerators - the case of HESS J1640-465

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HESS J1640-465 is one of the most extreme Galactic TeV gamma-ray sources that has been discovered with the High Energy Stereoscopic System (H.E.S.S.). The emission is likely associated to the shell-type supernova remnant (SNR) G338.3-0.0 with an estimated distance of ˜10 kpc, making HESS J1640-465 the most luminous Galactic source in the TeV regime. Recent multi-wavelength observations led to the interpretation that the TeV emission might be associated to an X-ray pulsar wind nebula in the center of the SNR.

Here we report on follow-up observations of HESS J1640-465 from 2004 to 2011 with H.E.S.S. and a re-analysis of archival XMM-Newton data to revisit the underlying radiation mechanisms and interpretation of the TeV signal from this region. The new H.E.S.S. data reveal a significantly extended TeV morphology with a substantial overlap with the northern part of the SNR shell. These new spectral and morphological results suggest that
at least part of the TeV emission is likely of hadronic origin with a total energy
in interacting protons of up to $W_p n_H \sim 4 \times 10^{52} (d/10\mathrm{kpc})^2$\,erg\,cm^{-3}.

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