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Title

VLA and XMM-Newton Observations of the SNR W41/TeV Gamma-Ray Source
HESS J1834-087

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Abstract

The recently discovered extended TeV source HESS J1834-087 is associated with both a diffuse X-ray enhancement and a molecular cloud, projected at the center of an old radio supernova remnant, G23.3-0.3 (SNR W41). New H I observations from the VLA Galactic Plane Survey (VGPS) show unambiguous structures associated with W41 in the radial velocity range of 53-63 km s⁻¹, so we obtain for W41 a distance of 4 ± 0.2 kpc. A new higher sensitivity VGPS continuum image of W41 at 1420 MHz shows faint emission in its eastern part not detected by previous observations, so we provide a new angular size of 36' × 30' in the *b-l* direction (average radius of 19 pc). We estimate for W41 an age of $\sim 10^5$ yr. A new *XMM-Newton* observation reveals diffuse X-ray emission within the HESS source and suggests an association between the X-ray and γ -ray emission. The high-resolution ¹³CO images of W41 further reveal a giant molecular cloud (GMC) located at the center of W41, likely associated with W41 in the radial velocity range of 61-66 km s⁻¹. Altogether, the new observations can be interpreted as providing the first evidence that an old SNR encounters a GMC to emit TeV γ -rays in the cloud material.

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