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H.E.S.S. ToO program on nearby core-collapse Supernovae : search for very-high energy gamma-ray emission towards the SN candidate AT2019krl in M74

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While the youngest known supernova remnants (SNRs), such as Cas A, have been proven to be able to accelerate CRs only up to $\sim 10^{14}\,\mathrm{eV}$, recent studies have shown that particle energies larger than a few PeV ($10^{15}\,\mathrm{eV}$) could actually be reached during the early stages of a core-collapse Supernova (cc-SN), when the high-velocity forward shock expands into the dense circumstellar medium (CSM) shaped by the stellar progenitor wind. Such environments, in particular the type IIn SNe whose progenitors may exhibit mass loss rates as high as $10^{-2}\,M_{\odot}\,\mathrm{yr}^{-1}$, would thus lead to gamma-ray emission from π^0 decay in hadronic interactions, potentially detectable with current Cherenkov telescopes at very-high energies (VHE). In that context, the High Energy Stereoscopic System (H.E.S.S.) has been carrying out a Target of Opportunity (ToO) program since 2016 to search for such an early VHE gamma-ray emission towards nearby (up to $\sim 10\,\mathrm{Mpc}$) cc-SNe and SN candidates, within a few weeks of discovery. After giving an overview of this H.E.S.S. ToO program, we will present the results obtained from July 2019 observations towards the transient AT2019krl, originally classified as a type IIn SN, which occurred in the galaxy M74 at $\sim 9\,\mathrm{Mpc}$. Although its nature still remains unclear, the derived H.E.S.S. constraints on this transient will be placed in the general context of the expected VHE gamma-ray emission from cc-SNe.

Keywords

supernovae; gamma rays; particle acceleration

Collaboration

H.E.S.S.

other Collaboration

Subcategory

Experimental Results

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