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X-ray observations of a PeVatron candidate HESS J1641-463

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HESS J1641-463 is an unidentified gamma-ray source characterized by a hard TeV gamma-ray spectrum, thus it has been proposed to be a primary candidate for cosmic-ray acceleration up to PeV energies (a PeVatron candidate). The source spatially coincides with a radio SNR G338.5+0.1, but has not yet been explored in the X-ray band. We here present a new 82 ks NuSTAR observation and archival 19 ks Chandra X-ray observations of this source. The NuSTAR observation is affected by stray light and the background; and while we detect a nearby stellar cluster, Mercer 81, we do not find an X-ray counterpart to HESS J1641-463. Combining the NuSTAR with the archival Chandra data, we derived an upper limit of $\sim 4 \times 10^{-13}$ erg cm⁻² s⁻¹ in the 0.5-20 keV band. If the gamma-rays are originated from pion decay produced in interactions between cosmic-ray protons and the ambient materials, secondary electrons in the proton-proton interactions can potentially emit synchrotron photons in the X-ray band. We present a detailed broadband SED modeling, and demonstrate how the secondary synchrotron component (for which we derive an upper limit with the present study) can be detected in sensitive, dedicated X-ray observations, particularly with future hard X-ray missions.

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