Abstract: HESS J0632+057 is an unidentified gamma-ray source located in the Monoceros region, probably associated with the massive Be star MWC 148. H.E.S.S. and VERITAS observations in the very high energy (VHE) range combined with Swift X-ray data indicate that this object is a new member of the elusive gamma-ray binary class. We present here results of VHE gamma-ray observations from VERITAS and HESS at energies above 100 GeV taken over more than six years. The observations confirm HESS J0632+057 as a point-like VHE source. A possible correlation of the gamma-ray flux variability pattern with X-ray observation is presented at the meeting. The VHE gamma-ray results and their astrophysical implications are discussed in the context of contemporaneous X-ray and high energy (HE) gamma-ray observations with Swift XRT and Fermi LAT.

Keywords: acceleration of particles binaries: general - gamma rays: observations - individual (HESS J0632+057)
tem is 5° (details about the detectors can be found in [2] and references therein).

VERITAS is an array of four imaging atmospheric-Cherenkov telescopes (IACT) located at the Fred Lawrence Whipple Observatory in southern Arizona. The field of view of the VERITAS telescopes is 3.5°. For more details on the VERITAS instrument, see e.g. [7].

Both instruments are very similar in their performance with large effective areas (\(> 10^5 \text{ m}^2\)) over a wide energy range (100 GeV to 30 TeV), as well as good energy (15-20%) and angular (\(\approx 0.1°\)) resolution. The high sensitivity of H.E.S.S. and VERITAS enable the detection of sources with a flux of 1% of the Crab Nebula in less than 30 hours of observations.

3 Observations of HESS J0632+057

HESS J0632+057 has been observed by H.E.S.S. and VERITAS in total for more than 150 hours in the past 7 years. While the timing of the observations in Autumn 2010 and Spring 2011 were motivated by the expected increase in X-ray flux as indicated by Swift XRT observations, the dates of all other observations were motivated by scheduling and technical constraints only. Table 1 and Figure 1 give an overview of the data sets, observing conditions and results.

VERITAS observed the sky around HESS J0632+057 during five periods between 2006 and 2011. About 110 hours of observations passed quality selection criteria, which remove data taken during bad weather or with hardware related problems, see Table 1. Data were taken under moonless or moderate moonlight conditions. The data sets from prior to 2008 consist of observations during the construction phase of VERITAS with three telescopes only. More than 95% of data taken from 2008 onwards are taken with the full VERITAS array of four telescopes. The data analysis steps are described in detail elsewhere (e.g. [11]).

HESS J0632+057 was observed yearly with HESS from 2004 until 2009, see Table 1. The observations were performed over a large range of zenith angles (28°–58°) with an average of 34.2°. The full HESS data set consists of approximately 47 hours of observations (after quality-selection cuts) and has been analysed here using HAP version 11.02.

4 Results and Discussion

A full presentation of the results from the analysis of the complete data set and their astrophysical implications will be presented at the conference.

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Figure 1: Top: Folded X-ray light curve for HESS J0632+057 (XMMU J063259.3+054801) assuming a period of 320 days [4] for an energy range 1.5-10 keV. These Swift X-ray observations of the source range from MJD 54857 to 55647, zero phase has been arbitrarily defined at MJD 54877, as in [4]. Bottom: VHE observations of HESS J0632+057 folded with the same phase as the top figure. Shown are H.E.S.S. flux measurements from 2004 and 2005 [3], and VERITAS flux upper limits (99% confidence) from 2006, 2008 and 2009 [1], both for energies above 1 TeV. Downward pointing errors show 99% confidence limits on the flux above 1 TeV assuming a spectral shape of \( dN/dE \propto E^{\Gamma} \) with \( \Gamma = -2.5 \). The grey boxes indicate the periods in phase covered by the observations described in Table 1.

Table 1: Details of the H.E.S.S. [3] and VERITAS observations of HESS J0632+057. Upper limits \( \Phi_{\gamma, UL}(E > 1 \text{ TeV}) \) are given at 99% confidence level (after [5]). The integral fluxes and upper flux limits are give for energies > 1 TeV. Results for the periods marked by (*) will be presented at the conference.