Observation of VHE Gamma Radiation from Galactic Sources with the MAGIC Telescope

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During its first year of operation the MAGIC telescope [1] has observed, besides other sources, four galactic sources of VHE gamma radiation: the Crab Nebula, the Galactic Center and two of the recently discovered sources HESS J 1813-17.8 and HESS J 1834-8.7 [2]. The steady flux of the Crab provides a good reference to validate the analysis techniques, especially the spectral and spatial source reconstruction methods. The Crab is a very interesting source as the acceleration mechanism of the VHE gamma radiation is still unknown and because the experimental results reported by CANGAROO and HESS are controversial. A few months after the initial discovery of HESS J 1813-17.8 and HESS J 1834-8.7 by the HESS experiment the VHE gamma-ray emission from these sources could be confirmed with the MAGIC telescope. Both sources spatially coincide with supernova remnants and allow to study the role of SNRs for the cosmic ray acceleration.

HESS J 1813-17.8:

HESS J 1813-178 (HESS1813) was initially assumed to be a "dark particle accelerator" as no counterpart at other wavelengths had been identified [2]. After the original discovery, HESS1813 has been associated with the SNR G12.8-0.02 [5,13,14].

Fig.1 shows the reconstructed VHE gamma-ray spectrum of HESS1813 (significance 10.6σ). The spectral points are unfolded with the energy resolution of the detector. A fit to a power-law (preliminary):

$$dN/dE = (3.3 - 0.5) \times 10^{-12} \text{cm}^{-2} \text{s}^{-1} \text{TeV}^{-1}$$

The most probable source position is (Ra,Dec)=(18h13m25s, -17°51'). The measured fluxes exhibit significant differences.

The Crab Nebula:

The Crab Nebula was the first source detected at TeV energies employing the IACT technique [10]. Its strong and stable gamma-ray emission makes it a standard candle in VHE astronomy. The Crab Nebula has been extensively observed over a wide range of wavelengths up to nearly 100 TeV [6]. Nevertheless, various new physics results are expected in the VHE domain, e.g. the spectrum showing the IC peak close to 100 GeV or the verification of true flux stability down to the percent level.

A total number of 20 hours of data taken in 2004 and 2005 have been included in this analysis [11]. For the gamma/hadron separation and energy estimation, so-called Random Forest methods have been applied [12]. The analysis yields a signal of 20.4 ± 1.6, fit with a power-law to the spectral points yields (preliminary):

$$dN/dE = (3.3 - 0.5) \times 10^{-12} \text{cm}^{-2} \text{s}^{-1} \text{TeV}^{-1}$$

The Galactic Center:

First detections of the Galactic Center (GC) were made by the Cangaroo, Whipple and HESS collaborations [7-9]. The measured fluxes exhibit significant differences.

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