

## Possible keV-TeV correlation in the reverse shock in Cassiopeia A

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### ABSTRACT

Suzaku X-ray observations of a young supernova remnant Cassiopeia A were carried out. The continuum emission is likely dominated by the non-thermal emission with a cut-off energy at  $\sim 3$  keV. The peak of the non-thermal X-rays appears at the western part. The peak position of the TeV  $\gamma$ -rays measured with HEGRA and MAGIC are also shifted at the western part with the 1-sigma confidence. Since the location of the X-ray continuum emission was known to be presumably identified with the reverse shock region, the possible keV-TeV correlations give a hint that the accelerated multi-TeV hadrons in Cassiopeia A are dominated by heavy elements in the reverse shock region.

KEY WORDS: ISM: individual (Cassiopeia A) – ISM:supernova remnants

### 1. Cassiopeia A

The young ( $\sim 330$  yr old) supernova remnant Cassiopeia A is one of several SNRs from which non-thermal X-rays and TeV  $\gamma$ -rays have both been detected (X-rays: Allen et al. 1997, Uchiyama et al. 2008, TeV: Aharonian et al. 2001, Albert et al. 2007). In X-rays Cassiopeia A seems to consist of a number of thermal and non-thermal X-ray emitting knots/filaments (Hughes et al. 2000, Hwang et al. 2004, Bamba et al. 2005). Although some non-thermal emission is associated with the

forward shock, the dominant source of non-thermal emission may be identified with the reverse shock regions (Helder et al. 2008 and references there in). It therefore is a unique object in which we can study the particle acceleration by the reverse shock, because for the other SNRs the acceleration seems to originate from the forward shock region only (e.g., Parizot et al 2006). In this paper, we present a Suzaku study of the X-ray emission from Cassiopeia A. More comprehensive results of the Suzaku observations are presented in Maeda et al.

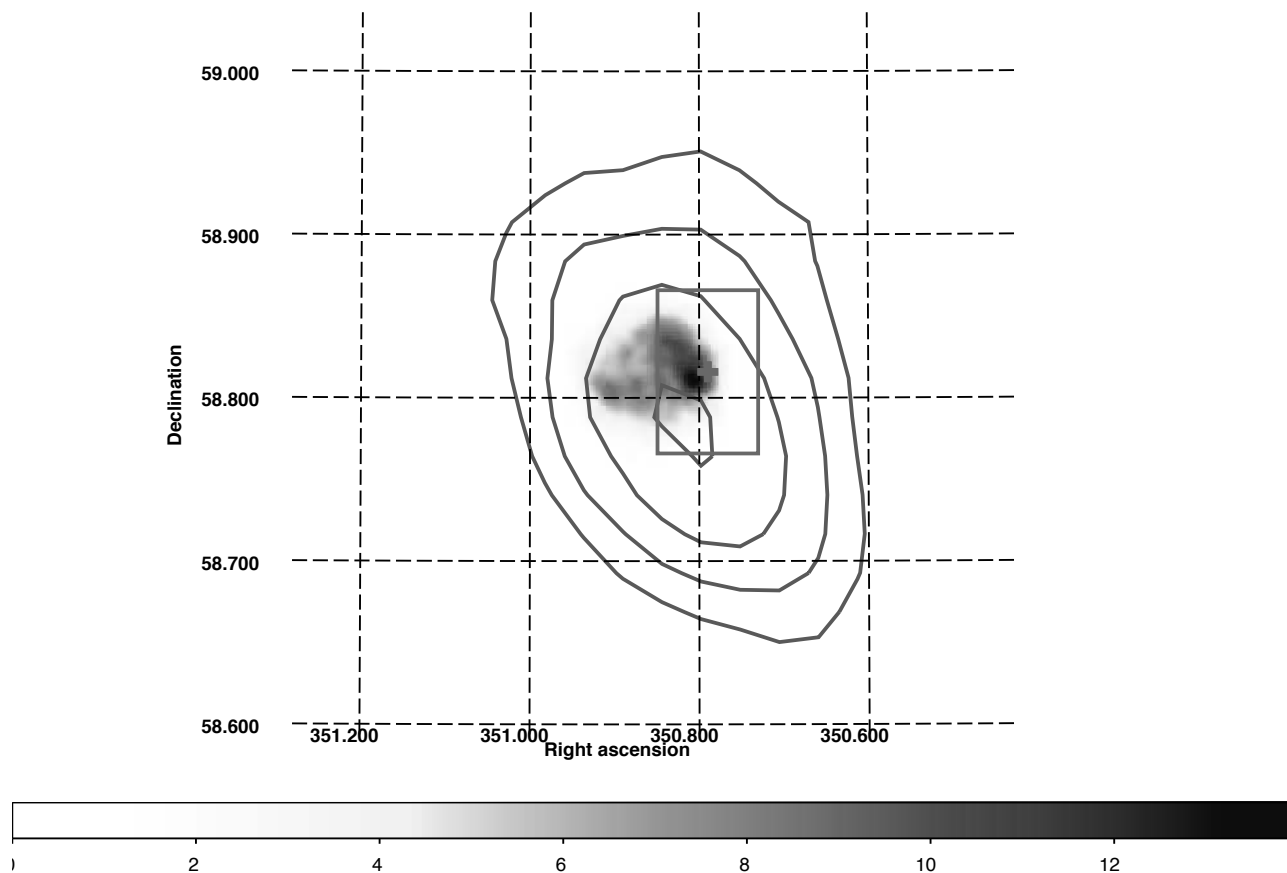


Fig. 1. XIS image in the 8–11 keV band overlaid with the MAGIC TeV contour. The cyan cross and its surrounding box correspond to the peak position of the MAGIC TeV source and its 1-sigma error, respectively. The right ascension and declination are written in J2000.

(2009).

## 2. KeV-TeV images

Figure 1 shows the 8–11 keV band image (likely the synchrotron TeV electron image) overlaid with the MAGIC TeV  $\gamma$ -ray contour published by Albert et al. (2007). The image peak of the 8–11 keV continuum emission is located near the TeV peak and within its error box. This gives us a hint that the peak of TeV  $\gamma$ -rays measured by HEGRA and MAGIC coincides with the location of the synchrotron-dominated western spot. This also suggests that the TeV  $\gamma$ -rays also can originate from reverse-shocked ejecta.

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