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X-ray imaging of the Cr and Fe lines from Cassiopeia A

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ABSTRACT

Follow-up Suzaku X-ray observations of a young supernova remnant Cassiopeia A carried out with a long exposure of ~ 165 ksec in 2012. Owing to the high statistics of the data, the map of Cr-K line is made. The flux map of Cr-K line is similar to that of Fe-K. The similarity indicates that the reverse shock is currently heating the electra layer that the Fe and Cr elements co-exists in.

KEY WORDS: supernova remnants – X-rays: individual(Cassiopeia A)

1. Introduction

Cassiopeia A is a young supernova remnant accompanied with a rich X-ray emission lines from various elements such as Fe (e.g., Serlemitsos et al. 1973, Holt et al. 1994). Yang et al. (2008) and Maeda et al. (2009) found an emission line from a minor element Cr. The Cr is theoretically predicted to be effectively produced in an incomplete silicon burning layer at the supernova explosion. We then investigated the layer by making a map of the Cr line. We present here preliminary results of these lines using the Suzaku XIS.

2. Observation and Data Reduction

The long exposure observation of Suzaku satellite has carried out in 2012 December. The XIS data were processed with the Suzaku pipe-line software (version 2.8).

During our observation, Cassiopeia A has experienced no occultation due to the earth. In order to earn photon statistics, a loose screening was then made with the following standard criteria: (a) only GRADE 0,2,3,4,6 events are selected, (b) the standard time interval after passage through the South Atlantic Anomaly. and (c) the object is at least 1 degrees above the rim of the Earth. Finally, the total net exposure time after this filtering is about 165 ksec for XIS.

2.1. Results

Figure 2 shows the energy-resolved images with the XIS in 6–7 band. It is confirmed that the Fe-K line is bright in the three region in north, west, and south east. Figure 2 shows the spectra of the four typical region of Cassiopeia A including the three regions. The flux ratio of Cr-K to Fe-K is constant with being constant at any region within

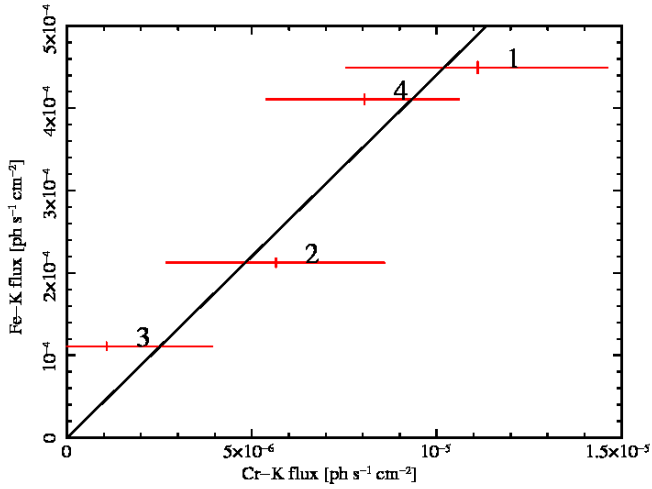


Fig. 1. Fluxes of Cr-K and Fe-K lines. Numbers correspond to those of the spectral region given in Figure 2.

the errors.

The Cr and Fe K-lines appears at the similar band between 5 and 7 keV. Therefore, the emissivity is less dependent on the temperature of the plasma, but is uniquely dependent on the abundance of the elements. This results likely suggest the co-location of the iron and chromium elements in ejecta that were heated with the reverse shock.

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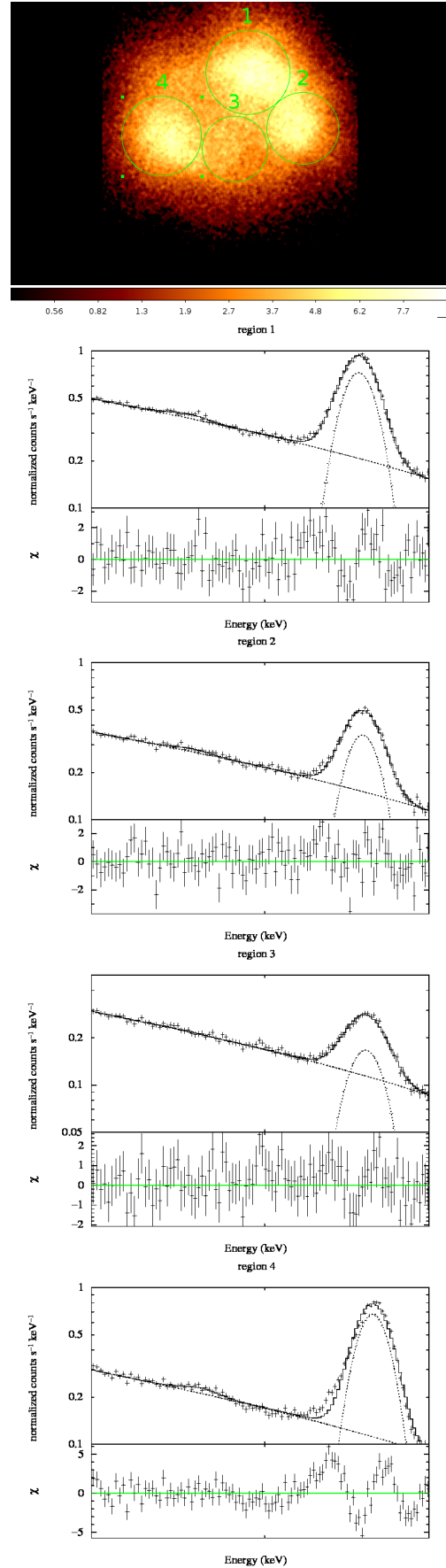


Fig. 2. XIS-0 image in the 6–7 keV band (top). XIS-0 Spectra of the four regions given in top panel are also plotted.