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Publication date
2014

Document Version
Final published version

Published in
Proceedings of Suzaku-MAXI 2014: Expanding the Frontiers of the X-ray Universe: February 19-22, 2014, Ehime University, Japan

Citation for published version (APA):

Download date: 27 Oct 2022
X-ray imaging of the Cr and Fe lines from Cassiopeia A

Yoshitomo Maeda1, Toshiki Sato1,2, Hiroshi Tsunemi3, Aya Bamba4, Jacco Vink5, Yukikatsu Terada6, Takafumi Takeda4, Makoto Sawada4, Poshak Gandhi7, Hironori Matsumoto8, Yasunobu Uchiyama3, Eveline A. Helder10, Junko Hiraga11, John P. Hughes12, Motohide Kokubun1, Toru Tamagawa13, Yohko Tsuboi14

1 Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA), 3-1-1 Yoshinodai, Sagamihara, 229-8510, Japan
2 Tokyo Metropolitan University, 1-1 Minami-Osawa, Hachioji, Tokyo 192-0397
3 Department of Earth and Space Science, Osaka University, 1-1 Machikaneyama-cho, Toyonaka, Osaka 560-0043, Japan
4 Aoyama Gakuin University, 5-10-1 Fuchinobe, Sagamihara 252-5258, Japan
5 Anton Pannekoek Institute/GRAPPA, University of Amsterdam, PO Box 94249, 1090 GE Amsterdam, The Netherlands
6 Saitama University, Shimo-Okubo 255, Sakura, Saitama 338-8570, Japan
7 Department of Physics, Durham University, Durham DH1-3LE, UK
8 Nagoya University, Furo-cho, Chikusa-ku, Nagoya, 464-8602
9 College of Science Department of Physics, Rikkyo University, Nishi-Ikebukuro 3-34-1, Nerima-ku, Tokyo
10 Department of Astronomy and Astrophysics, The Pennsylvania State University, 525 Davey Laboratory, University Park, PA 16802, USA
11 Research Center for the Early Universe Graduate School of Science, The University of Tokyo
12 Department of Physics and Astronomy, Rutgers University, 136 Frelinghuysen Road, Piscataway, NJ 08854-8019, USA
13 Cosmic Radiation Laboratory, RIKEN, 2-1 Hirosawa, Wako, Saitama 351-0198
14 Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo 112-8551

E-mail(TS): toshiki@astro.isas.jaxa.jp

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 Cr 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 Cr 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 0,2,3,46 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

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

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.

We also thank all members of the Suzaku team. This work is partly supported by a Grant-in-Aid for Scientific Research by the Ministry of Education, Culture, Sports, Science and Technology (25105516).

References

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.