Suzaku X-ray spectroscopy of a peculiar hot star near the Galactic center

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Abstract

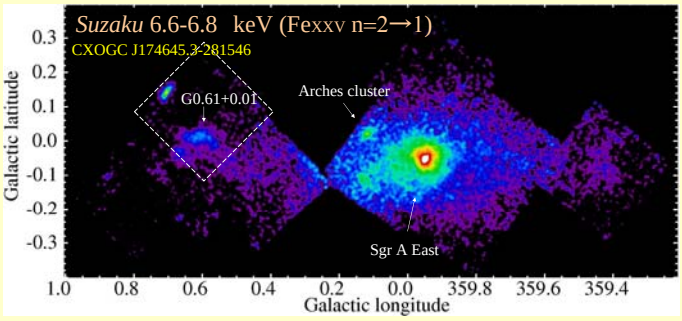
We are conducting a deep survey program of the Galactic center using Japanese X-ray satellite *Suzaku*. As a part of this program, we performed a ~33 hour observation toward the Sgr B north region. A bright point-like source (CXOGC J174645.3-281546) was detected near the edge of the FOV. We detected an intense Fe XXV Kα line with an equivalent width of ~1 keV. The overall X-ray spectrum is very well described by an APEC (optically thin thermal plasma) model with a temperature of ~5×10^7 K and Fe abundance of ~0.8 solar absorbed by an inter-stellar column of N_H~2×10^{23} cm^{-2}. We also analyzed the archived data of *Chandra* and *XMM-Newton* and find that the X-ray flux spanning ~6 years shows year-scale time variability of a factor of ~2. The probable counterpart in the IR bands is very bright (L_{bol}=$10^{4.9}$ L_o) and has a cool (T_{BB}~1000 K) spectral energy distribution. The most plausible nature of this source is a carbon-rich Wolf-Rayet binary system. (Hyodo et al. 2008, PASJ, accepted)

1. Introduction

The distribution of the 6.7 keV line (FeXXV Kα) emission along the Galactic plane is strongly peaked at the Galactic center (Koyama et al. 1989). Whether this emission is composed of numerous point sources or truly diffuse emission has been a point of debate for a long time. With *Chandra*, only 10 % of this emission was resolved into point sources (Muno et al. 2004). Although the dominant fraction of these point sources are thought to be cataclysmic variables for its large population, the nature of each sources are unknown.

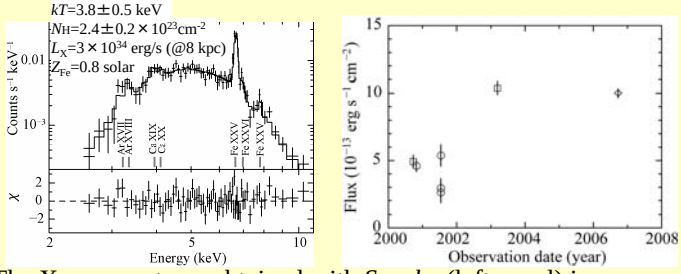
In the Galactic center region, early type stars are concentrated to the three compact clusters of young stars (the Arches, Quintuplet, and central cluster). Portegiez Zwart et al. (2001) claimed that the number of young massive star clusters may exceed 50 in the Galactic center region. Recently, the combination of X-ray and infrared observations have discovered unidentified early-type stars in the Galactic center region (Muno et al. 2006, Mikles et al. 2006, Mauerhan et al. 2007). In this poster, we present a new Wolf-Rayet binary candidate (CXOGC J174645.3-281546) which has a strong 6.7 keV line, at a projected distance of ~100 pc from the Galactic center.

2. Observation

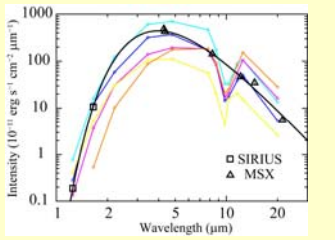


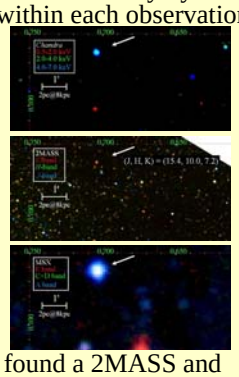
We have conducted a ~1 Ms Galactic center survey using XIS on board *Suzaku*. The observation toward the Sgr B north region (a white square in the above figure) was performed on 2006 Sep. 21-25 for ~33 hours. Though the main target was G0.61+0.01 (Koyama et al. 2007), CXOGC J174645.3-281546 (Muno et al. 2006) was detected near the edge of the FOV. We also analyzed the archived data of 4 *Chandra* observations and 2 *XMM-Newton* observations. To characterize the multi-wavelength features of CXOGC J174645.3-281546, we examined the data of 2MASS, SIRIUS (Nishiyama et al. 2006), and MSX.

3. Analysis



The X-ray spectrum obtained with *Suzaku* (left panel) is characterized by a strong cut-off below ~3keV and a very strong emission line at 6.66±0.01 keV (EW~1 keV) in addition to half a dozen of weak emission lines. The overall spectrum is well reproduced by an optically-thin thermal plasma model (APEC) with the parameters shown in the upper left corner. The X-ray light curve spanning 6 years shows year-scale time variability by a factor of ~2, while short-term variability within each observation are not significant.

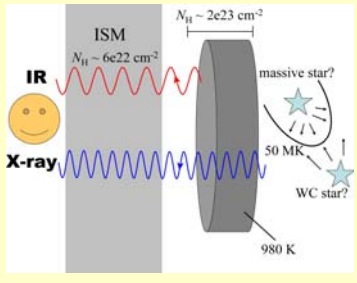




Within the position uncertainty (~2"), we found a 2MASS and MSX source (right panels). The K-band brightness of 7.2 mag and the red SED is very similar to those of eponymous Quintuplet cluster members (colors in left panel; Okuda et al. 1990, Figer et al. 1999). The SED can be fitted blackbody radiation with T_{BB}=980±20 K and A_V=31±1mag.

4. Discussion

Some of evolved massive star binary systems have large X-ray luminosity up to ~10^{35} erg/s with thermal spectra of ≥ 2 keV (WR140; Koyama et al. 1994, η Car; Tsuboi et al. 1994, Arches cluster; Wang et al. 2006).



The nature of the eponymous Quintuplet cluster members are thought to be WC stars (Tuthill et al. 2006).

Circumstellar dust emission with temperature of 700-1700 K is a common character of WC stars (William et al. 1987)

We conclude that the most plausible nature of this peculiar source is a WC star + massive star binary system. X-ray sources like this would comprise substantial fraction of 6.7 keV line in the Galactic center region.

References

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