ASCA Discovery of the New Magnetic Cataclysmic Variable AX J2315−592

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Abstract

The new magnetic cataclysmic variable (CV) AX J2315−592 was discovered by *ASCA* and identified as a new AM Her type object.

The light curve shows a clear modulation at the period of 5360sec . The X-ray spectrum is represented by hard thermal bremsstrahlung with negligible absorption and strong iron K emission line, which are typical of magnetic CVs. The large amplitude variation observed in this object are characteristics of AM Her type objects. Modulation amplitude is, however, found to be smaller in higher enrgies, which is seen in intermediate polars in general. From these X-ray properties, the possible accretion pole geometry is discussed.

1. Observations and Results

During an observation of the infrared luminous galaxy IRAS 23128−5919 with *ASCA*, the new magnetic CV AX J2315−592 was discovered (Misaki et al. 1995) and identified as a AM Her type object (Thomas and Reinsch 1995). Unfortunately, AX J2315−592 is out of the field of view of the SIS and the only GIS data is available.

From a raw light curve, periodic intensity modulation is seen and the X-ray period was determined to be 5360±50 sec, which is consistent with the period 5360±10sec determined by the optical follow up observations (Thomas and Reinsch 1995). From the light curve folded at the optical period in three energy band (Ishida 1996; Fig 3.), the modulation amplitude is found to be smaller in higher energies. This energy dependence is rather like intermediate polars (Norton and Watson 1989, Ishida 1991) in contrast to a modulation amplitude of AM Her type stars which is almost energy independent.

We show the GIS2 + GIS3 spectra of phase=0.23−0.63 (rotational maximum phase) and phase=0.83−1.03 (rotational minimum phase) in Fig 1. The rotational maximum spectrum is well represented by thermal bremsstrahlung ($kT = 19^{+5}_{-4}$ keV) with a negligible absorption ($N_{\rm H} < 6 \times 10^{20}$ cm^{-2}) and a Gaussian (center energy $E_L = 6.84^{+0.13}_{-0.09}$ keV, width $\sigma = 0.35^{+0.24}_{-0.13}$ keV, equivalent width = 910^{+310}_{-200} eV).

The rotational minimum spectrum is, on the other hand, extremely hard and cannot be represented by a thermal bremsstrahlung with absorption by single clumn density. We have introduced partial covering model as conventionally done for magnetic CVs. Due to statistical limitations, we have fixed the temperature at the values obtained for the rotational maximum spectrum. The best fit values of absorption column density and covering fraction are $N_{\rm H} = 4.2^{+2.0}_{-1.6} \times 10^{23}$cm^{-2}, 0.88±0.04, respectively. Detailed fitting results can be found in Misaki et al. 1996.

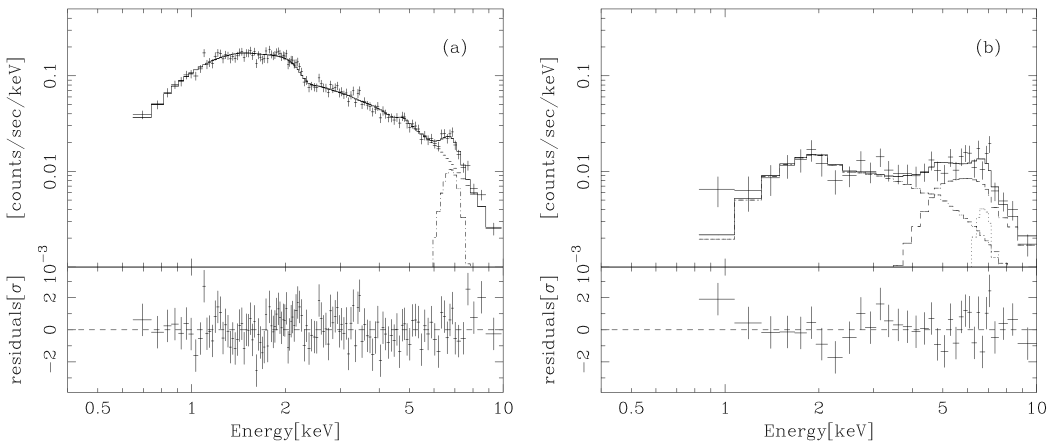

Fig. 1. ASCA GIS spectra of AX J2315−592 of (a)rotation maximum and (b)rotation minimum phase

2. Discussion

The observed energy dependence of the modulation amplitude is atypical of AM Her type stars, and rather like intermediate polars. In AM Her type stars, the mass accretion takes place in almost single pole and the modulation is considred to be caused by the eclipse of the accreting pole.

In explaining the energy dependence of modulation amplitude of AX J2315–592, we consider it is most likely that single accretion pole on the upper hemisphere is always visible by the observer and never crosses behind the limb of the white dwarf. This idea is supported by the facts that the rotational minimum spectrum can be explained by the same intrinsic spectral model as the rotational maximum phase with extra partial covering, and that the phase of the rotational minimum and that of the inferior conjunction of the secondary coincide within $\Delta\phi < 0.1$. The latter strongly suggests that the accreting pole points towards the observer during the rotaional minimum phase and that the intensity modulation is caused by the absorption in the preshock accretion column.

3. References

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