J202a NuSTAR Observation of the Intermediate Polar AE Aquarii

Takao Kitaguchi (RIKEN), Hongjun An (McGill Univ.), Andrei M. Beloborodov, Eric V. Gotthelf (Columbia Univ.), Takayuki Hayashi (ISAS/JAXA), Victoria M. Kaspi (McGill Univ.), Vikram R. Rana (Caltech), Fiona A. Harrison (Caltech), Daniel Stern (Caltech/JPL)

AE Aquarii (AE Aqr) is a cataclysmic variable with the fastest known rotating magnetized white dwarf $(P_{\rm spin} = 33.08 \text{ s})$. Compared to many intermediate polars, AE Aqr shows a soft X-ray spectrum with a very low luminosity, and therefore the mechanism and location of the X-ray emission are uncertain. In addition, a *Suzaku* observation showed that AE Aqr may emit non-thermal hard X-rays with a narrow pulse profile at the spin period, suggesting that the source may accelerate charged particles in a fashion similar to rotation-powered pulsars. However, a more recent *Suzaku* observation did not reproduce the earlier result.

The NuSTAR satellite, which carries the first focusing hard X-ray (3–79 keV) telescope in orbit, can help measure the maximum temperature of the thermal plasma in AE Aqr and test the presence of any beamed non-thermal component. We have analyzed overlapping observations of this system with NuSTAR and Swift in September of 2012. We find the 0.5–30 keV spectra to be well fitted by either an optically thin thermal plasma model with three temperatures with the highest temperature of $9.3^{+6.1}_{-2.2}$ keV, or an optically thin thermal plasma model with two temperatures plus a power-law component with index of 2.5 ± 0.2 . The 3–20 keV pulse profile is broad and approximately sinusoidal with a pulsed fraction of $16.6 \pm 2.3\%$. We do not find any evidence for a sharp feature in the pulse profile. Possible interpretations of the observed X-ray emission are discussed.