# High-Resolution X-Ray Spectroscopy of Astrophysical Plasmas with XRISM

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The X-Ray Imaging and Spectroscopic Mission (XRISM)[1], developed by JAXA and NASA with ESA's participation, has been operating in orbit since September 2023. The X-ray microcalorimeter "Resolve" on board XRISM achieved an energy resolution of ~4.5 eV (FWHM) in the 2-10 keV band, providing us new insights into astrophysical plasmas in different spatial scales, including galaxy clusters[2], active galactic nuclei[3], supernova remnants[4], and X-ray binaries[5]. For instance, the Resolve successfully measured the bulk velocity of the hot intracluster medium in the Centaurus Cluster with an accuracy of 10-50 km $s^{-1}$ using the well-resolved K-shell emission lines of He-like and H-like Fe, revealing the evidence of past cluster mergers[2]. From the X-ray binary Cyg X-3, the Resolve detected both emission and absorption features of Fe ions in various charge states (Fig.1), allowing us to constrain the velocity and density profiles of the plasma surrounding the binary system and even the mass of the compact object[5]. In this talk, I will review some initial results from XRISM and describe successes and challenges in modelling of high-resolution spectra based on our current knowledge of atomic processes.

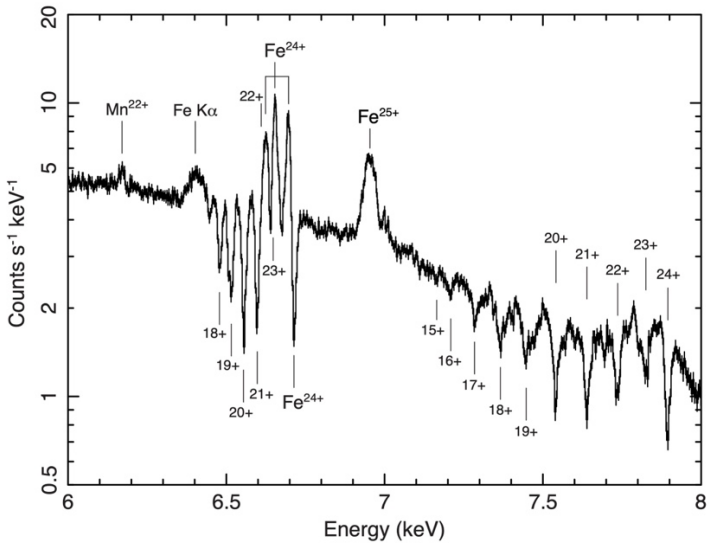


Figure 1: The Resolve spectrum of the X-ray binary Cygnus X-3 in the 6-8 keV band

References

[1] M. Tashiro et al., PASJ, in press. (2025) DOI: 10.1093/pasj/psaf023
[2] XRISM Collaboration, Nature, **638**, 365 (2025)
[3] XRISM Collaboration, ApJL, **973**, L25 (2024)
[4] XRISM Collaboration, PASJ, **76**, 1186 (2024)
[5] XRISM Collaboration, ApJL, **977**, L34 (2024)