HIGH RESOLUTION SPECTROSCOPY OF HIGH VELOCITY WINDS IN GALACTIC X-RAY SOURCES

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[Contributed talk, 15min.]

Abstract

After its first two years of operation, the High Energy Transmission Grating Spectrometer (HETGS) onboard the Chandra X-ray Observatory has produced a large number of high resolution X-ray spectra providing us with unprecedented spectroscopic details. Spectra from winds in Galactic X-ray sources reveal plasmas in a wide range of temperatures, including cold, optically thick flourescent matter, warm photoionized regions, and hot regions where collisional ionization and scattering dominate the emission. What they all have in common is the coexistence of various states of matter within relatively confined volumes. With the application of line diagnostic tools we are able to model temperature and density ranges. ¿From the HETGS spectra we also measure line shifts and widths caused by velocity fields which constrain the geometry of the X-ray emitting plasma.

Accretion disk winds in low-mass X-ray binaries such as Cir X-1, EXO 0748-676, and possibly 4U 1626-67, reveal themselves through high velocity line shifts and broadenings of the order of 500 to 4000 km s^{-1} and electron densities between 10^{12} and 10^{15} cm^{-3}. The line strengths indicate characteristics of photoionized plasmas, but we also observe emission from hybrid plasmas as well as inhomogeneities in these winds. Such inhomogeneities may also be present in the ionized winds of high-mass X-ray binaries. In spectra from Vela X-1 and GX 301-2, we resolve a large number of K-shell emission lines from a highly photoionized plasma but also several M- and L-shell transitions from lower Z elements. Perhaps the most complex system is Cyg X-1, a black hole candidate with a high-mass companion. Its spectra show a variety of spectral features, which relate to outflows from the accretion disk as well as absorption in the focussed wind of the companion. Here, X-rays from the companion wind seem important as well, which is also indicated from HETGS observations of single early type stars.

CATEGORY: BLACK HOLE AND NEUTRON STAR BINARIES