

The Young Be-Star X-Ray Binary Cir X-1

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Abstract

Accretion conditions and morphologies of X-ray transients containing neutron stars are still poorly understood. Circinus X-1 is a specifically enigmatic case where we observe X-ray flux changes covering four orders of magnitude. We observed Circinus X-1 many times since the launch of the Chandra X-ray Observatory using the high energy transmission grating spectrometer and each time the source gave us a vastly different look. Most recently we caught the source at its very lowest X-ray flux at a flux of 1.8×10^{-11} erg cm⁻² s⁻¹. Its spectrum, a single 1.7 keV blackbody spectrum, showed a low emission radius of 0.5 km which implies a high magnetic field between 0.4 and 2.5×10^{11} G depending on neutron star radius. Photoionized line emissions suggest a large emission volume and low plasma densities. The observed bluehifts of ~ 400 km s⁻¹ and emission volume is consistent with the ionized but distorted wind of a B5Ia supergiant companion confirming a previous identification. We argue that the companion of Cir X-1 is fast rotating Be-star and its stellar disk provides much of the observed excess column densities. We paint a scenario in which a precessing oblate Be-star rotator may explain the vast X-ray flux variations in the past.