ChamPlane Chandra/HST survey of low-extinction windows in the Galactic Bulge
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The ChamPlane Multiwavelength Plane (ChamPlane) project is an extensive x-ray/optical/IR survey to study the population of low-luminosity accreting binaries in the Galactic Bulge and Galactic Center region where Cham has revealed a still largely unidentified population of hard point sources (Muno et al. 2003). We are conducting an x-ray/optical survey of selected regions in the Bulge where the low extinction still allows optical follow-up studies of sources in the 3ugle. Our main motivations are to study the properties of accreting binaries in the Bulge and trace the radial gradient of the intriguing Galactic Center population. See also the posters by Hong et al. and Laycock et al.

source classification

Binaries are detected in x-rays in various stages of their evolution. X-rays trace ongoing interactions, like tidal interaction or mass transfer. The properties and relative frequencies of interacting binaries in subsequent evolutionary phases can constrain binary evolution models - one of the main motivations of ChamPlane. Comparison of the interacting binary population in the Bulge with the local disk population or with (dynamically enhanced) globular cluster populations allows tests of binary formation scenarios.

candidate catalyptic variables

We have identified several likely catalyptic variables in BW and SW. The figure below shows the optical spectrum and light curve of the source marked as □ in Figs. 3 and 4.

Fig. 1 Hydra spectrum (left) and OGLE light curve of a candidate catalyptic variable in SW.

We use their typically blue colors and excess Ha/Hea emission to identify candidate catalyptic variables in HST/ACS images.

Fig. 2 left ACS/F814W image centered on a source in BW. The 95% confidence circle (1” radius) on the x-ray position is shown in red. Right F435W/F606W (B+R) and F555W/F606W (\(B+\text{Hea}\)) versus R color-magnitude diagrams of stars in a 20” x 20” region around this source. Stars inside the inner circle are marked in red. One source stands out as being relatively blue and Ha/Hea bright.

candidate symbiotic binaries in the bulge

4 BW and 9 SW sources have M-giants in their error circles. Tests indicate this is more than expected from random coincidences. These sources typically have hard x-ray spectra and some appear intrinsically absorbed (c in Fig. 3). With x-ray luminosities between 10^{39} and 10^{40} erg/s (0.5-8 keV, for a distance of 8 kpc), their x-ray emission is well above the measured values or upper limits for the intrinsic emission of M-giants. We suggest these sources could be symbiotic binaries where the wind of a late-type giant is accreted by a binary companion - typically a white dwarf but in some cases (e.g. GX1+4) a neutron star - and explains the enhanced absorption. Assuming mass loss rates typical for luminosity class III giants (10^{-8}-10^{-7} solar mass/year) and orbital periods typical for known symbiotic systems (100 d to a few years) we derive that absorption by the stellar wind can be sufficient to explain the excess absorption along the line of sight as derived from x-rays. These sources are two bright in the IR to explain the hard source population in the Galactic Center (see also Laycock et al. 2005).

coronally active binaries

Cross-correlation of the ChamPlane source lists with OGLE variable catalogues has resulted in possible counterparts for 15-20% of the sources in BW and SW. Based on the optical light curves, many of the matched sources (● in Figs. 3 and 4) can be classified as close binaries (contact binaries, detached eclipsing binaries).

http://hea-www.harvard.edu/ChamPlane

references

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