Chapter 3

Thesis Conclusions & Future Research Directions

In Chapter 1, we reviewed ways in which compact objects emit high energy radiation from accretion-related processes in close binary orbits with another star. We finished with a brief introduction to the GBS, a shallow *Chandra* survey designed to locate a large quiescent LMXB population in the Galaxy. In doing so, it would homogenize the current sample of XRBs which is skewed towards bright and/or transient sources. In Chapter 2, we conducted a multi-wavelength analysis of 269 *Chandra* X-ray sources in the GBS using the *GALEX* UV dataset as a basepoint for counterpart matching. We performed SED fitting on photometric data from several optical and IR surveys, each with different photometric errors and standards. We found that the main areas of concern/error in accurately interpeting SED fitting of photometric data are a) the degeneracy of temperature, normalization and extinction and b) the high probability of inherent variability from a UV/X-ray-matched source in a Galactic dataset. For Galactic sources, knowledge of either $E(B-V)$ or distance yields the other with up-to-date dust maps of the galaxy, reducing this degeneracy. When extinction is known in advance, we recover many of the already-identified spectral types to an accuracy of ($\sim \pm 3$ sub-types) despite real variation of stars within a single spectral type and differences in template libraries (a $\sim \pm 3$ sub-type difference also partially represents the precision to which these papers originally identified them).

The *GALEX*/*Chandra* dataset is dominated by coronally active single stars/non-compact binaries (RS CVn, Algols, BY Dra). These are B-M field stars peaking in the G-type, with very few M-dwarfs. There were 61 sources which could not be modelled by single-stellar templates alone, of which 30 are presented individually on the basis of UV flux excesses beyond empirical limits on single stars. The *GALEX* UV rise is often correlated with a rise in the nearby SDSS u' band as well revealing a smaller, hotter blackbody component. Although we did not directly identify a single LMXB in the dataset, these systems are the only sources whose SEDs would reasonably suggest so. We interpret 7 of these as accreting COs (likely accreting WDs), 5 of which appear to be plausibly symbiotic in nature with a KIII or MIII giant companion from spectral fitting. Shell-burning symbiotics show strong emission lines (e.g., H I, He II, OIII) (Section 1.1.2) and are steady in the UV. Non-shell burning symbiotics do not show such lines, and instead show short-timescale UV variability from the accretion disk. *GALEX* NUV *timeseries* data is now available in the *gPhoton* package (Million et al., 2016) in observing windows of $\sim 1-2$ ks in total and at least 100+ s per observation. The combination of (even low-resolution) optical spectra with UV timeseries could confirm either case and possibly identify them as part of the 'hidden' population (Mukai et al., 2016).

Finally, we suggest both *Swift* optical spectra and simultaneous *Swift* UVOT photometry in X-ray, UV and optical bands using the co-aligned XRT (0.3-10keV) and UVOT (1930 $\sim$ 5470 Å) instruments for all 30 systems in the final UV excess set. Certainty of observational simultaneity removes the problem of variability and extensive UV coverage can identify $E(B-V)$ accurately: this is more or less the ideal SED analysis setup. Fine spectra may show any number of features: the equivalent width (EW) of $H\alpha$ elucidates the presence of a disk, and can also distinguish between coronal activity and a CVs/qLMXB ($EW < 15-18$ Å limit for active chromospheres in M-dwarfs West et al., 2008). We may also estimate $E(B-V)$ using diffuse interstellar bands (DIBs). This spectral analysis would be conducted in a similar fashion to Torres et al. (2014) which identified 23 accreting binaries in the GBS by these spectral signatures. Even though an optical spectrum can provide as much or more information about a system than our SED analysis, it usually isn't clear *where* the spectrum observation should be centered. Only in cases where the X-ray positional error radius is small is this obvious, and the corresponding *GALEX* position is the suggested origin. We have also made available all photometric data, fitting results and plots to significantly reduce the collaboration's time in finding counterparts, converting them to a common flux system, assessing the relative photometric errors and performing the spectral fitting for reasonable extinction values.